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MODEL AIRPLANE NEWS

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Build the CHANDELLE Sailplane

How to Scratch-Build

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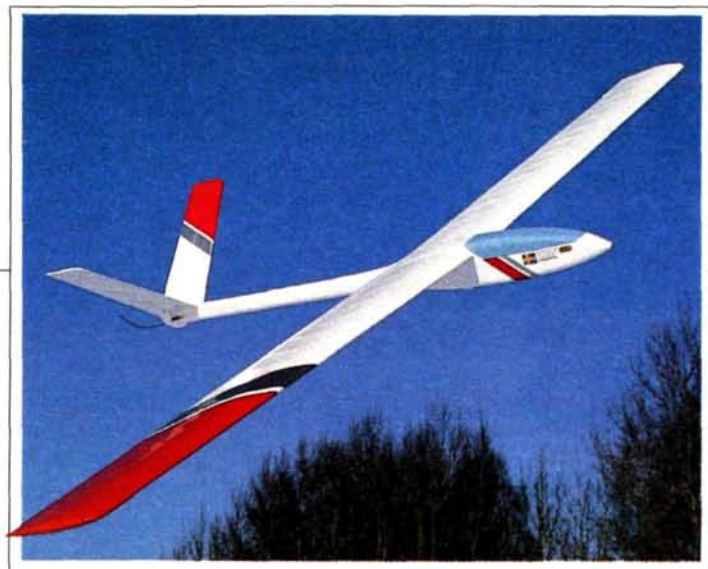
MODEL AIRPLANE NEWS



ABOVE: Sailplanes have magic, as does the Chandelle, featured in this issue on page 16.
ON THE COVER: The Mustang has an appeal unlike any other airplane. This shot shows another angle of Ed Bowlin's machine, taken at Ontario during the popular Canadian Warplane Heritage annual last August. Ed's wife, seen in the back seat, is a rated P-51 jock. For more on the famous Mustang, see page 40. Photo by Budd Davisson.

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

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Editorial

by DAN SANTICH

THE HOBBY OF R/C MODELING has become one of the fastest-growing pastimes of our society. Thousands of new, enthusiastic, and well-intending individuals are laying aside their bowling balls and golf clubs and investing their time and money in radio-control airplanes, cars, and boats. Growth means success, and I doubt if anyone would disagree with the idea that the more people we have to enjoy the hobby, the more power we'll have in gaining public access and recognition.

Unfortunately, along with growth comes pain.

Recently at a national scale competition, two world-class scale airplanes were zapped out of the sky by a man and his son who were operating an R/C car in the vicinity of the contest. Their car was being controlled by a radio that was on an aircraft frequency.

Is ignorance a valid excuse? Who is to blame? The car and the radio were purchased at a local hobby shop, the same day as the incident, and the buyer was unaware of the consequences of his deed, since in his view he was sold a product that was viable and legal. How was he to know it wasn't?

I'm sure that many other such incidents have occurred. The question is, how do we deal with it? I feel that surface radios should have a limited power output. And in addition, all surface radios should be only on the 27 MHz band. All surface transmitters should be of the pistol-grip style with a wheel for directional control instead of gimbal sticks.

The problem has a root, *the radio system.* Every radio sold should be labeled exactly what the application should be. The seller of the radio system, too, should make the buyer aware of its proper use, and the consequences of misuse.

Will these measures solve the problem? Perhaps in the long run they could. But in the meantime, we've got to take *action* on our own to insure the safe operation of our models. We can do this by scouting the area for potential interference, having more monitors—and we can educate the local merchants who sell model products. We can post signs. Write to radio manufacturers.

Education is the key to success, from which we all benefit.

THIS MONTH. The P-51 is everyone's favorite aircraft, and Hobby Shack knows it. Their new E-Z kit, reviewed by Richard Uravitch, is a fun airplane that lets you fly instead of build.

You want excitement? Try the new Super Hots kit from Midwest—reviewed by Chauncey Dance.

Top that off with a construction article on a neat sailplane, coverage of the Riverside Four-Cycle Ralley, some basics of scratch-building, and you'll have plenty to choose from in this issue! DBS

Airwaves

Pondering Flight

I've been pondering a remark given in an old editorial (March '85)....

I wish to embellish a portion of what you brought up, Mr. Santich, regarding the old notion of modelers as frustrated full-scale pilots. This letter, however, isn't just a supporting defense; I wish to share an opinion.

Why do we fly model airplanes? Though my experience with true flight is limited to commercial travel and to some hands-on training in sailplanes, and my modeling experience stems from a few gliders and trainers flown at Cape Cod, permit me, if you will, this speculation: We first learn a love of flight watching a brilliant sea gull soar above the dunes, or a falcon become a comet in its dive to a target on the plain. We would want to do the same. Twenty, thirty, or forty years later, some of us find that we carry either a private pilot's license or a seven-channel transmitter with a familiar heft.

Once we accept that the human body does not fly, our various aspirations are put into perspective. Unless we sprout feathers, mankind won't fly in the *first person.* At best, as full-scale pilots, we may, however, fly in the second person or, as modelers, in the third. Which alternative is better is entirely subjective. I believe that second- and third-person flight are complementary and require mutual respect, rather than comparative evaluation.

However, my lack of experience notwithstanding, I conclude that in an ironic way, I side with the modeler. Perhaps, *empathize* is the better word: An eagle passes overhead. The piloting of a full-scale plane is a valiant attempt to emulate the eagle, but to the discerning dreamer, will that desire ever really be realized? The flying of a model is the *observation* of the eagle turning high above as we, earthbound, are contented with this wheeling embodiment of the dream, and with the simple wonder of what it must be like.

THOMAS W. WOLFF JR.
Eastchester, NY

See Sally Fly

The Sally B B17G on its first outing with the new olive drab paint to combat erosion on the bare aluminum skin. I took it from ground level, which indicates that the pilot is really flying it. The show was the War Birds 1984 at West Malling near London, and included Wildcat FM2 (my favorite), Corsair, Bearcat, Fiat G47, Five Spitfires, nine Havards, three C-47s, and 72 paras jumping. It was organized by the Sally B preservation club—I just wanted to share a memory.

ERIC FEARNLEY
Grimsby, England

Thanks for sharing it with us. DBS

Name The Plane

I believe I have solved your "Name The Plane Contest" for April, only because I love to hang around the library and read. When I picked up the much awaited issue of *Model Airplane News,* I rushed to read it (and it was great as usual). As I reached the contest, I was shocked because I recognized, for only the third time ever, the plane. Fifteen minutes and three books later, I had it: a Lockheed Constitution. This has to be one of the worst planes in the whole book! It was heavy (92 tons), underpowered, and gulped its fuel, never reaching its planned range of 5,000 miles.

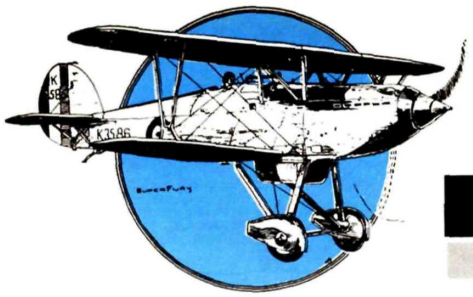
I'd also like to know if there are any R/C clubs—air or ground—in my area. I'd be very grateful if you could tell me, because I sometimes see a passing R/C plane but could never trace it.

The last item is one of personal distress. I've correctly answered one or two other contests and never seen my name on the list. That makes me wonder if only the first is accepted. I think that there are probably others who are confused, and it would help a lot if you'd explain. I love your mag and read it every month at the library, when the issue isn't stolen.

DUFFEY WOLVIN
Everett, WA

The best place to check is your local hobby shop. They'll know about the clubs and flying fields, if any, in your area. Also, the "Name The Plane" winners are selected at random from correct entries received. DBS

*We welcome your comments, opinions, and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 632 Danbury Rd., Wilton, CT 06897. Letters may be edited for clarity and length.*



Fifty Years Ago

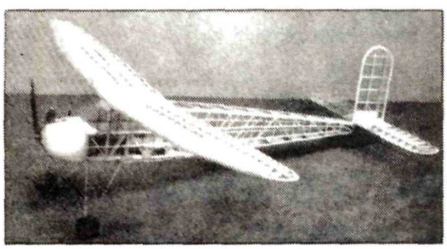
by DAN SANTICH

IN FEBRUARY 1937, transatlantic air travel was becoming very regular. It was also becoming very profitable for a German firm called Luftshiffbau Zeppelin, Gmbh. Formed in 1895 by Count Zeppelin, who completed his first airship in 1900, the firm built large numbers of airships between 1900 and 1918. Upon the signing of the Treaty of Versailles, all work was halted—but not for long. Zeppelin built two small passenger airships known as the Bodensee and Nordstern, which were later confiscated by the French and Italian governments. Before this occurred, the airships accumulated 103 trips and carried 4,050 passengers up to 1924. The United States Government acquired from the Germans an airship known as the L.Z. 126, which was flown across the Atlantic from Germany. The U.S. Navy took possession and renamed it Los Angeles. It seemed the United States was impressed, since by the end of 1936 the revenue gained by airships was over 2,000,000 marks. Late in 1936 a new airship named Hindenburg was also completed and made 10 scheduled journeys from Frankfurt to Lakehurst, New Jersey, and back. Travel by airship was *the* way to go to Europe, or at least that was the popular feeling. In May 1937 this would change.

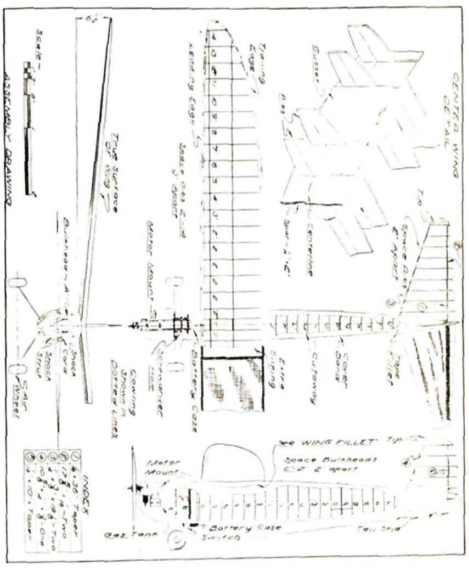
Modeling enthusiasts were treated to a host of new engines, kits, and designs in the February 1937 issue. Leo Weiss designed a model he named the Aristocrat, which was to set the stage for future model design, and Megow introduced the Flying Quaker kit, which featured a 7-foot wingspan and sold for $5. The Baby Cyclone engine set a new record by running continuously for 100 hours, wide open—4,100 rpm.

Modelers and companies that made the products were brought together in *Model Airplane News* magazine in 1937, fifty years ago this month. ■

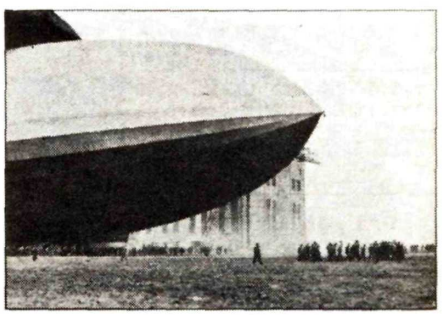
Megow's of Philadelphia offered kits to the modeler for decades.



Henry Stiglmeier of Inglewood, California, adapted building techniques influenced by his experience in rubber-powered models to this gas model.



A very streamlined design for the period was Leo Weiss' Aristocrat.

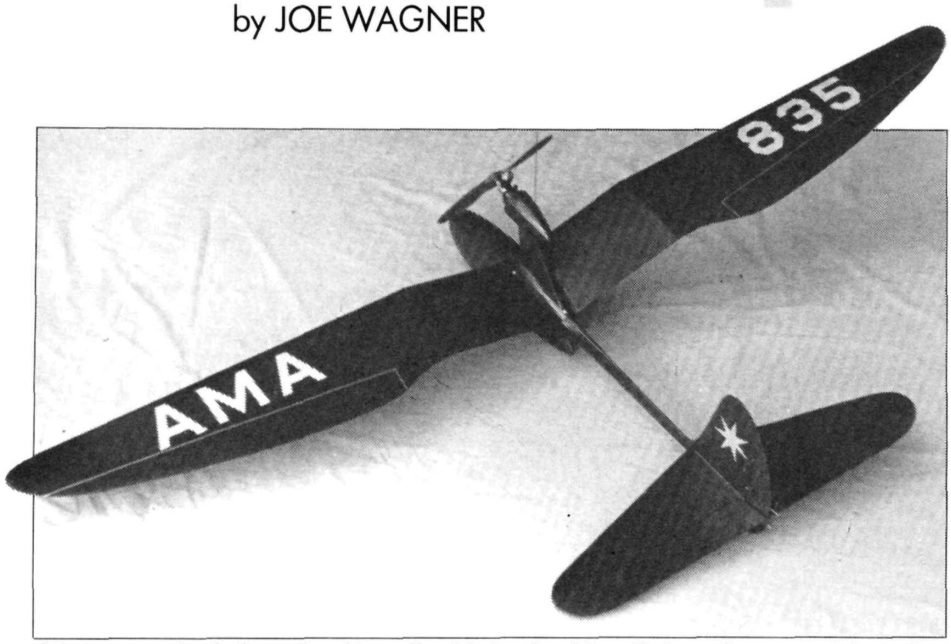


The airship Hindenburg exits its hangar and prepares for another flight.

The Baby Cyclone spark-ignition engine was widely accepted and used by modelers around the world.

Small Steps

by JOE WAGNER



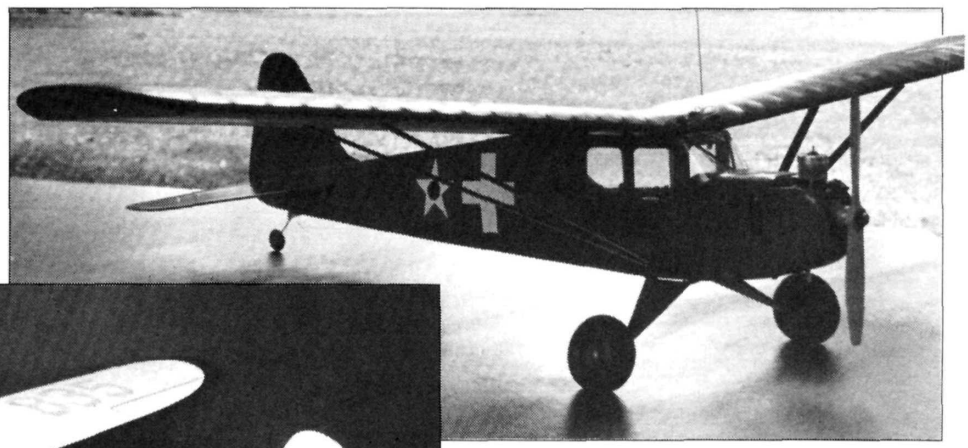
Like its namesake, the Storm Petrel is small and dark-colored. Its gull wing makes a pretty sight circling beneath white cumulous clouds.

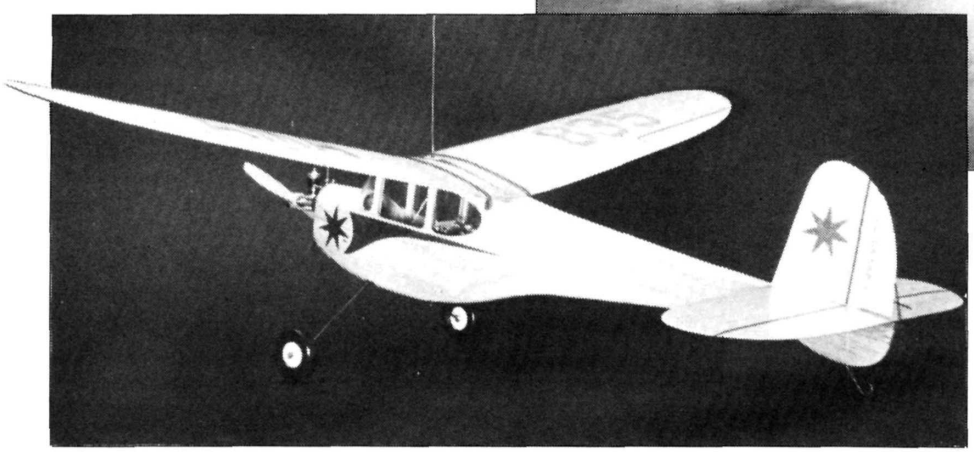
IT SEEMS to me that in our hobby of building and flying model airplanes, the most important "law" is not an aerodynamic one, such as Bernoulli's Law. It's the Law of Diminishing Returns. Briefly stated, this "law" says that the more and more effort you put into a project, the smaller and smaller the degree of improvement becomes.

This certainly holds true for model airplanes. Of the hundreds of models I've built and flown since 1935, those that I've enjoyed the most have invariably been smaller "sport" types. Sure the fancy, elaborate scale models and the gigantic big-engine-powered jobs were impressive—maybe even prestigious. But they were a lot of hard work. I didn't get into this hobby with the idea of having to slave incessantly to get an airplane ready to fly. I wanted to have fun! Thus, the model types that I keep returning to, over and over, are the ones that deliver as much enjoyment as possible for the amount of effort I put into them.

That means small, simple, moderate-performing models; especially the kind I can fly right in my own neighborhood. In fact, that's about the only kind of model I build any more. It's so relaxing to take an airplane in one hand and a little field box in the other, walk a half-mile to the school athletic field, and spend a calm summer evening lazily circling, looping, and soaring my model over the soft grassy slopes. I need no starter, electric fuel pump, or "power panel" with its heavy battery. This is a good example of how *less* can become *more*. Less trouble, expense, and complexity in modeling provides me with more scope for flying: more places to fly, and more opportunities to use them. In short: more *fun*.

I'm not the only one who has experienced this. For instance, my colleague Randy Randolph, who lives in Dallas, one of America's busiest metropolitan areas, is able to fly his small R/C models exactly the way I do mine. He goes up the street to the local schoolyard to fly his models in the evenings, and with no hassle or complaints from the neighbors. Randy, too, is having a lot of fun with small R/C models.





Above: A .19-powered Ace Air Scout modified to look like a 1941 Army observation ship. Left: A school-yard sweetheart, this .020-powered Starling is all sheet balsa.

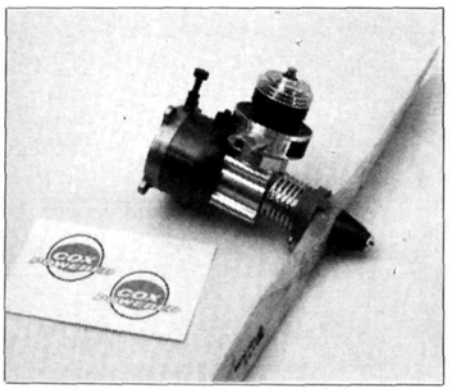
Small models are safe as well. Not weighing much nor flying fast, they're little danger to people or property. Their

This Black Magic has 350 square inches of wing area and at 25 ounces flies easily on an .049 engine.

engines put out modest sound levels, too. That may be the reason non-modelers seldom object to the flying of small R/C models near residential areas.

What kind of models are best for this sort of fun activity? In general they are (1) lightweight; (2) moderately-powered; and (3) stable in flight.

Light weight is of great importance. Weight determines the minimum flying speed. The less weight, the slower an airplane is able to fly and remain under control. Excessive weight not only forces an aircraft to go faster to stay in the air, it also lowers the top speed. If that seems contradictory, think of the photo-reconnaissance airplanes of World War II. Without the heavy load of guns and ammunition of their fighter counterparts, the recon jobs were far faster. In modeling, light weight is even more important than in full-scale aviation. The heavier your model is, the harder it strikes any obstacle in its path; and the more impact force it generates. You can truly make a model more damage-resistant by lightening it than by beefing it up, if you go about the job sensibly.



Cox QRC .049 is an ideal motor for small R/C flying.

Moderate power has several advantages. A low sound level is one; lessened fuel consumption is another. Small engines can usually be hand-started without difficulty or danger; and when they do happen to run into something they don't wreak the damage a screaming .60 will. True, a .049 will not haul a 4-foot R/C model vertically. But once you learn how to fly R/C on the wings rather than on the brute thrust of the engine, a whole new flight regime becomes open for your exploration.

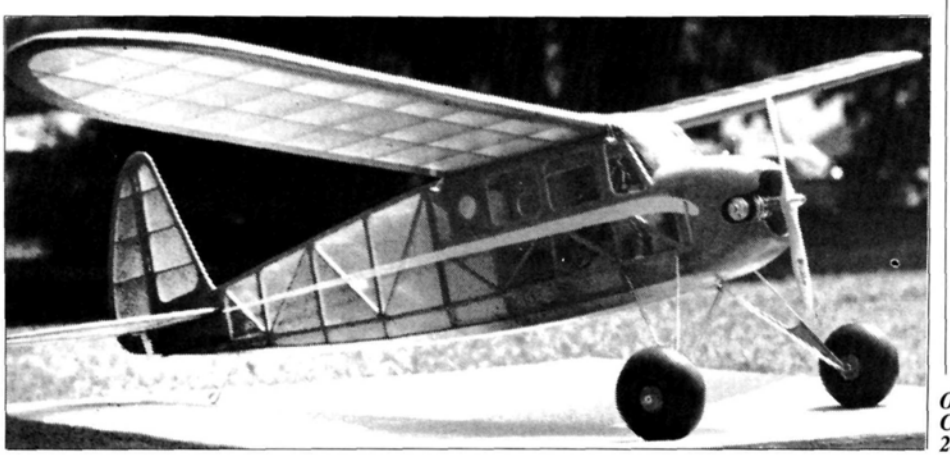
Flight stability makes a big difference, too. If your model can fly "hands off," it's more relaxing. You can look away from it from time to time to converse with one of the neighbors. Maybe you could even give him a turn on the transmitter to help build interest and good will for our hobby.

As for control systems, two- or three-channel equipment is all you need. Single-channel, rudder-only flying is still fun, but its equipment is no longer on the market. In any case, I've found that 2-channel (rudder and elevator) is more flexible. Rudder-only models need calm air for relaxed flying. With elevator control added, you can fly safely in fairly windy weather—and you can do lots more in the way of maneuvering.

Throttle control is nice to have, but it requires an extra servo plus a linkage around the fuel tank and engine to the carburetor. On a small model this can become tricky to accomplish. On my own .049 R/C jobs I usually omit the throttle and fly full power. When the engine stops I merely glide around a while, then land dead-stick. In fact, I land dead-stick just about all the time, even with throttle-equipped engines, because the kind of sport-type R/C models I like most—the ones this column is about—will always glide nicely without power.

That's one way to define the type of model that Randy and I are talking about in this new column. Generally speaking, this kind of airplane can be readily hand-glided. As with free flight ships, you can test-glide them before power flight, and get the balance point and control surface settings worked out at low risk. That can often help minimize repair work on a brand new model....

(Continued on page 98)



Old Timers make great R/C models. The 1938 Cleveland Cloudster has 51-inch span and weighs 28 ounces. Uses Cox Dragonfly engine for power.

Construction

A SAILPLANE FOR AEROBATICS FROM SWEDEN

CHANDELLE

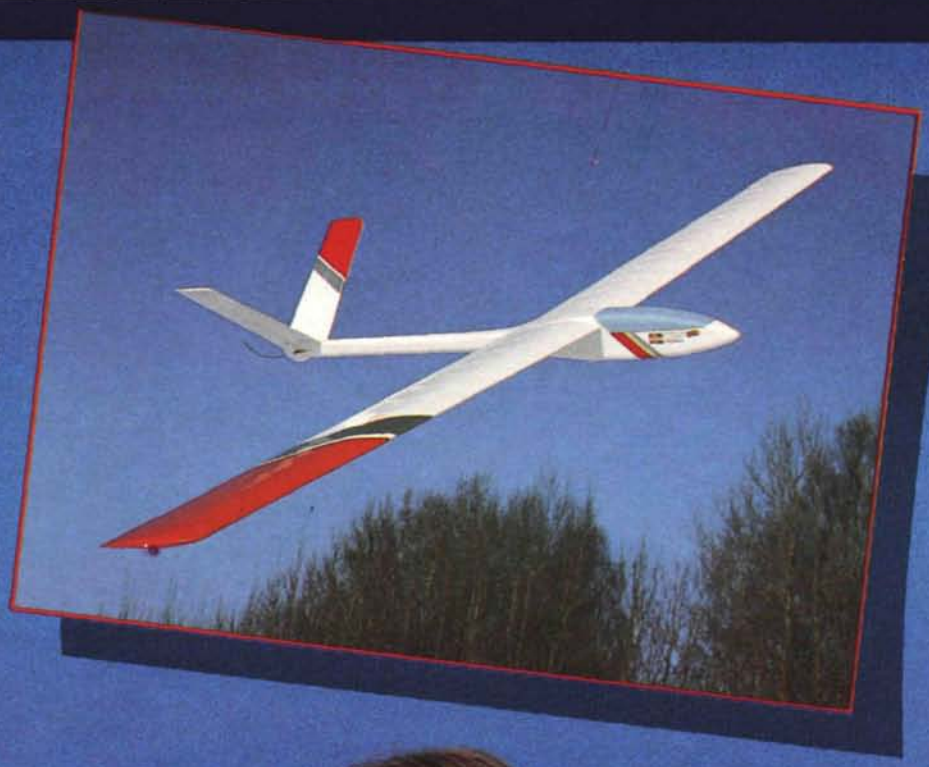
by MATS JOHANSSON

A few years ago I had the opportunity to fly as a passenger in an aerobatic flight with a full-size ASK-21 sailplane. The pilot was a flight instructor who showed me all the plane's tricks: hammerheads, loops, rolls and inverted flying. This flight so impressed me that I got the idea of making a model sailplane with this aerobic performance. First, I thought the aircraft needed a wide speed-range; and I consequently searched in every airfoil book I could find. Then, in a German book with different airfoil sections, I found it—Eppler 374 "Mit guten Ruckenflugeigenschaften," *with good inverted flying capabilities* it said.

Then I started to sketch on a V-tailed design with 78 inches span. About 12 months later, the prototype was ready to be test-flown. The test flight was a success. The plane looped easily and there was no need to dive vertically to obtain the necessary speed. Just a little forward pressure on the stick—and then pull back! The rolls are equally simple to do. You just dive gently, raise the nose a bit and then push the stick over to one side. To see a sailplane roll is very nice, and the Chandelle does it just great. When flying the Chandelle inverted, you only need to make a slight adjustment on the elevator trim to keep the plane upsidedown.

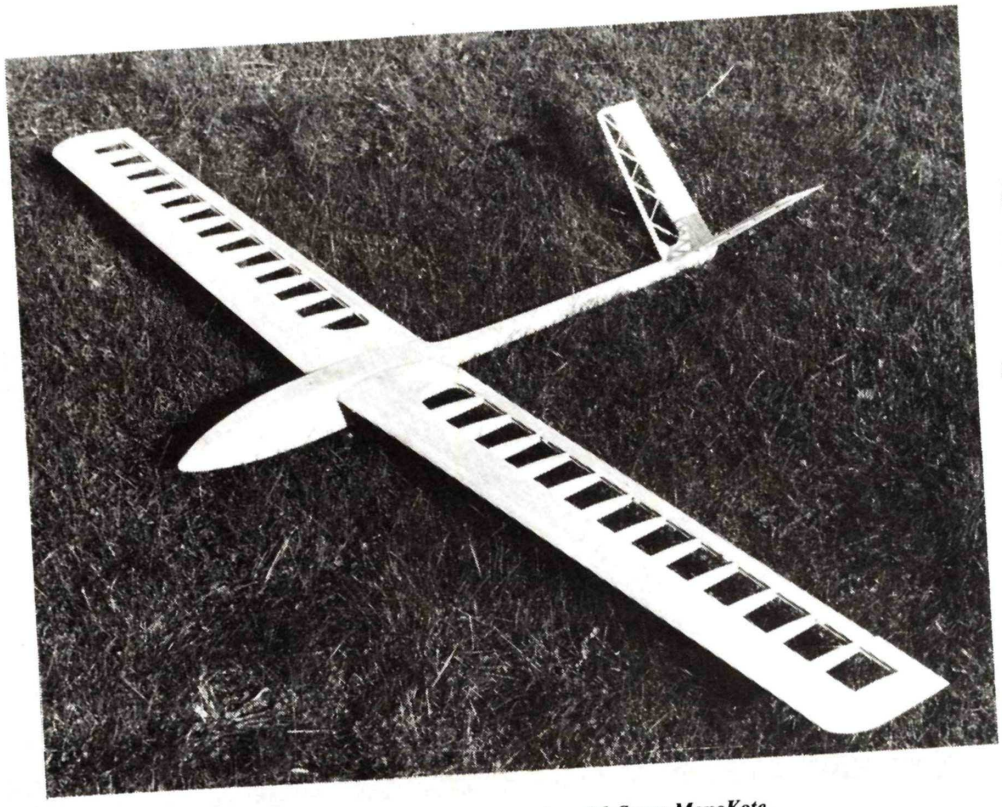
The Chandelle can do all pattern maneuvers, including outside loops, hammerheads and hesitation rolls, but it can't do spins. That's why you make low-speed landing approaches with your Chandelle without fear that the plane might tip-stall and spin into the ground at the final turn. Instead, it has very good stall characteristics: it just drops the nose a bit and continues to fly.

I've avoided using materials that I feel are hard to work with, like glass and carbon fibers. I've used only ordinary construction materials—balsa, spruce, and plywood—to make it easy for you to build your own Chandelle. The wing is built-up around a strong I-section of spruce and balsa that is reinforced at the root with plywood webs. When assembled, the wing is absolutely flutter-proof. The E-374 airfoil gives the Chandelle an extremely good performance

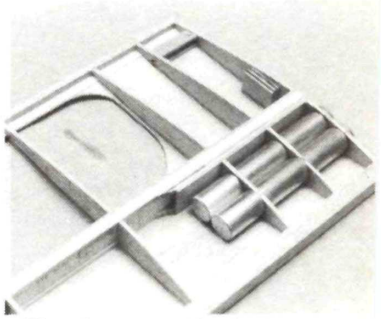


Span: *79 inches*
Area: *575 square inches*
Weight: *2.25 pounds*
Channels: *3 or 4*

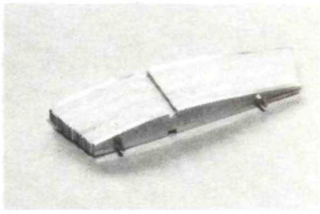
and you can fly ahead of the powered trainers at the local field with it! The wing panels are secured by a strong ¼-inch steel rod that can take extremely high G-loads during aerobatic sequences. A rubber band holds the wing panels tight to the fuselage, which is of a simple box design with 5/32-inch-square stringers in the corners, so you can sand the fuselage as round and smooth as expensive fiberglass fuselages.



The Chandelle airframe ready for covering with Super MonoKote.



The wing root with aluminum ballast tubes. Note wing rod reinforcements.



Method of making wing ribs as described in text.

FULL-SIZE PLANS AVAILABLE... PAGES 116, 117

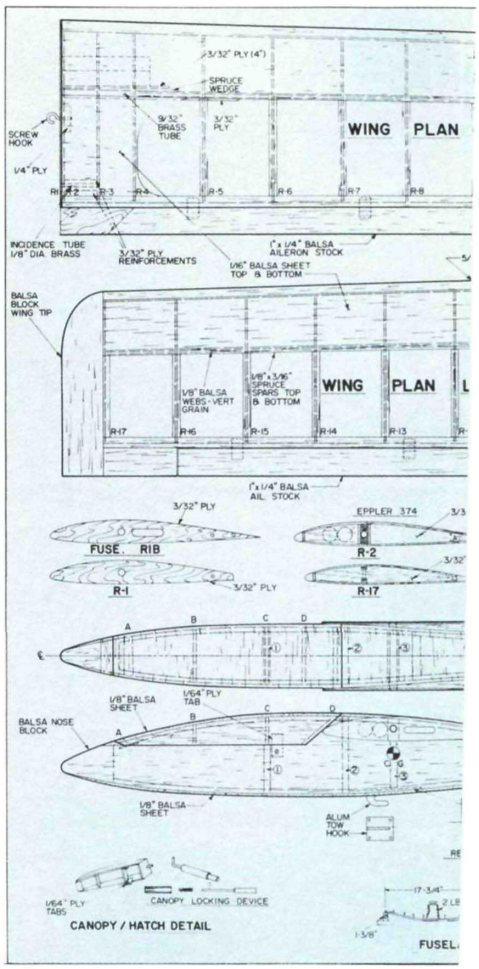
The Chandelle has a V-tail as does the German full-scale aerobatic sailplane Salto. This arrangement induces low drag and is lighter than a conventional tail. There are no differences in flying a V-tail airplane from flying one with an ordinary stabilizer and fin. When you're building your Chandelle make sure that everything is straight; be sure to get the true shape of the airfoil when you sand the wing structure.

This shot demonstrates the flat glide and aerobatic capability of the design.

CONSTRUCTION. Start by cutting out all necessary parts of the fuselage. Formers 1 to 4 are made of sandwich construction. Assemble the fuselage sides with the formers and make sure that everything is straight. Install the aileron control devices, wing-rod tube, and the incidence tube in the fuselage. Before you attach the over- and under-sides of the 1/8-inch balsa, you have to install the pushrod and antenna tubes. Continue with the canopy, which consists of 1/8-inch balsa parts and 5/32-inch-square stringers.

Now go on to the wing panels. Since the wing is tapered, you have to make all the ribs in different sizes. Make two templates in 3/32-inch aluminum of ribs 2 and 17. Then cut out 16 balsa pieces and thread them on two 3/32-inch piano wires. Put the templates on both sides of the balsa pieces and sand the balsa to the true airfoil shape. Assemble the wing parts on the plan. Before you glue the upper part of the spar in place, you have to install the wing-rod tube with its wedges for correct dihedral and swept-wing offset. If you like, you can install aluminum tubes for ballast in front of the spar before you cover the upper side of the wing with 1/16-inch balsa.

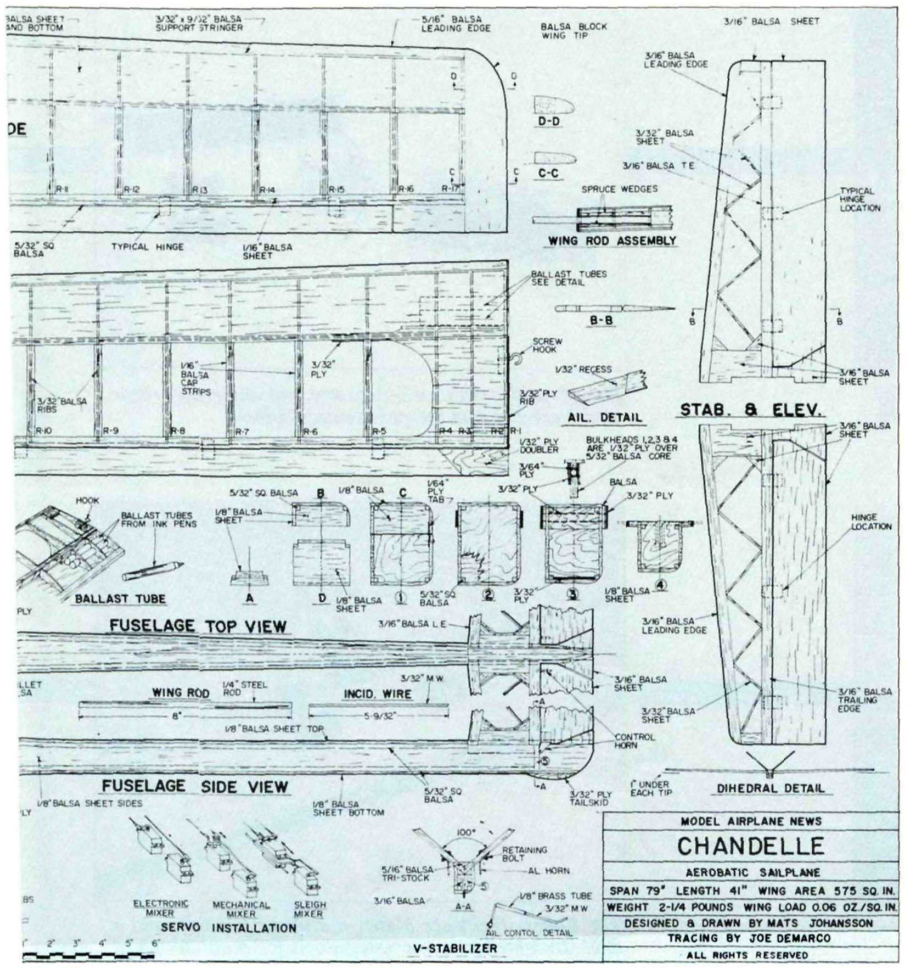
The V-stab is easy to build. Just make sure not to build-in any warps. To control the V-stab you can choose from three

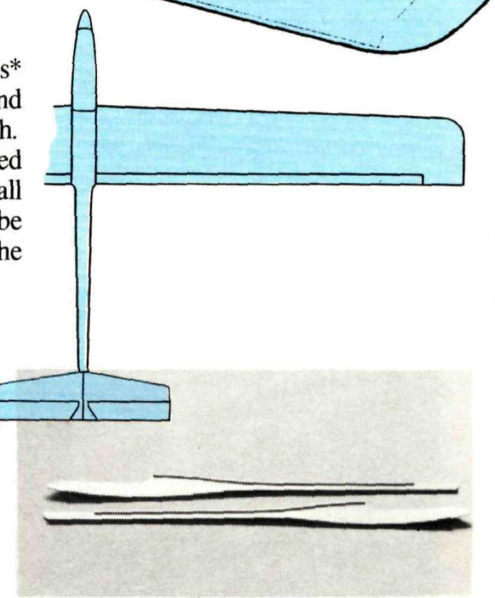


different systems—electronic mixer, mechanical mixer, and a "sleigh." I used the last system, which has worked very well. In the sleigh system, the rudder servo is fixed on a movable mount, a sleigh. This sleigh is then controlled by the elevator servo.

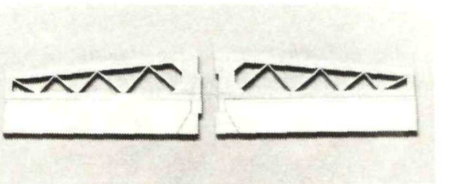
To complete the construction, cover the wings and stabilizer with Top Flite's* Super MonoKote, or the equivalent, and cover the fuselage with silk for strength.

FLYING. Make sure the C/G is located as shown on the plan, and check that all angles are correct. Also, you should be sure that all control surfaces move in the right direction.





Fuselage sides ready with their built-in curvature.



V-tail utilizes conventional techniques. Note notch in center section.

Start with a few hand-launches to trim the model out and then continue with hi-starts. After a few test flights, you can go on with the aerobatic maneuvers.

I hope your Chandelle will bring you joy in the constructing and the flying. And you might even agree with my assessment, that the Chandelle is *a pilot's aircraft.*

**The following is the address of the company mentioned in this article:*

Top Flite Models Inc., 2635 S. Wabash Ave., Chicago, IL 60616. ■

Basics of Scratch

This is the first in a series of articles designed to help the first-time scratch-builder. It's really quite easy to build a model from a set of plans if you pay attention to these basic steps. There's nothing difficult or mysterious about building from plans, only methods and techniques. Once mastered, you can build the most intricate and difficult projects with ease.

Part II of this series will deal with the actual assembly of your model. Part III will show you how to cover it and install your radio, and the final installment will show you how to trim out your model and fly it.

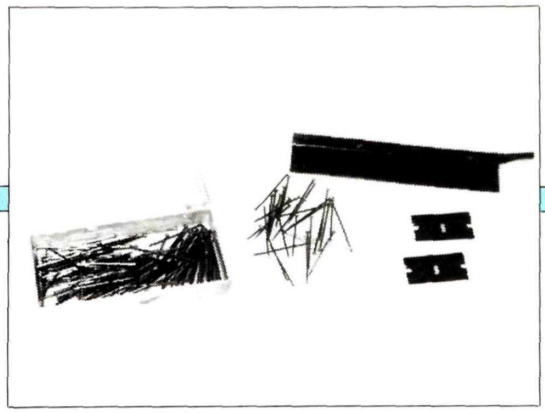
WHEN MODELING began there were no plans or instructions, or, for that matter, tools and building materials. The first man-made flying object was probably the spear, which evolved into an arrow shot from a bow. Certainly a rock or stone was the first thing propelled by man, but his craftsmanship had little to do with the way in which it flew. How times have changed! Now we can build creations that stay aloft for as long as we wish, although some of them still emulate the flight pattern of the stone. Be that as it may, great success and gratification can be had from the application of your craftsmanship, and since the way has been paved for you, it's merely a matter of choice.

Why build from scratch? First, it's cheaper. Second, you have the advantage of selecting the materials you want versus those that you are given in a kit. Third, you have the opportunity to add a bit of individualism to the design. Last, it's more rewarding from an achievement standpoint.

So how do you go about building a model from scratch? There are a few basic things to do and remember that will apply to any model, regardless of the degree of difficulty engineered into the model.

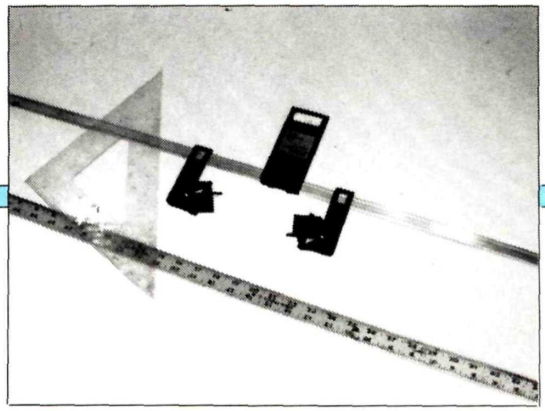
Selecting the model to scratch-build is very important, particularly for the person who's never tried it. There are no real mysteries or great difficulties, just apprehension. The purpose of this article is to

The adhesives used by the majority of modelers today include various configurations of cyanoacrylate and the tried-and-true standby, Elmer's aliphatic resin.



Pins of various sizes, an X-Acto saw, and single-edge razor blades are common inexpensive necessities.

Your sandpaper assortment should range between coarse-, medium-, and fine-grit paper.



The Robart Incidence Meter, a drafting triangle, and a steel straightedge are necessary tools for accurate model building.

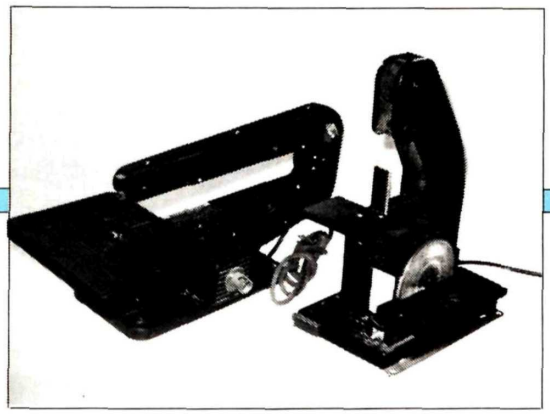
building

by Dan Santick

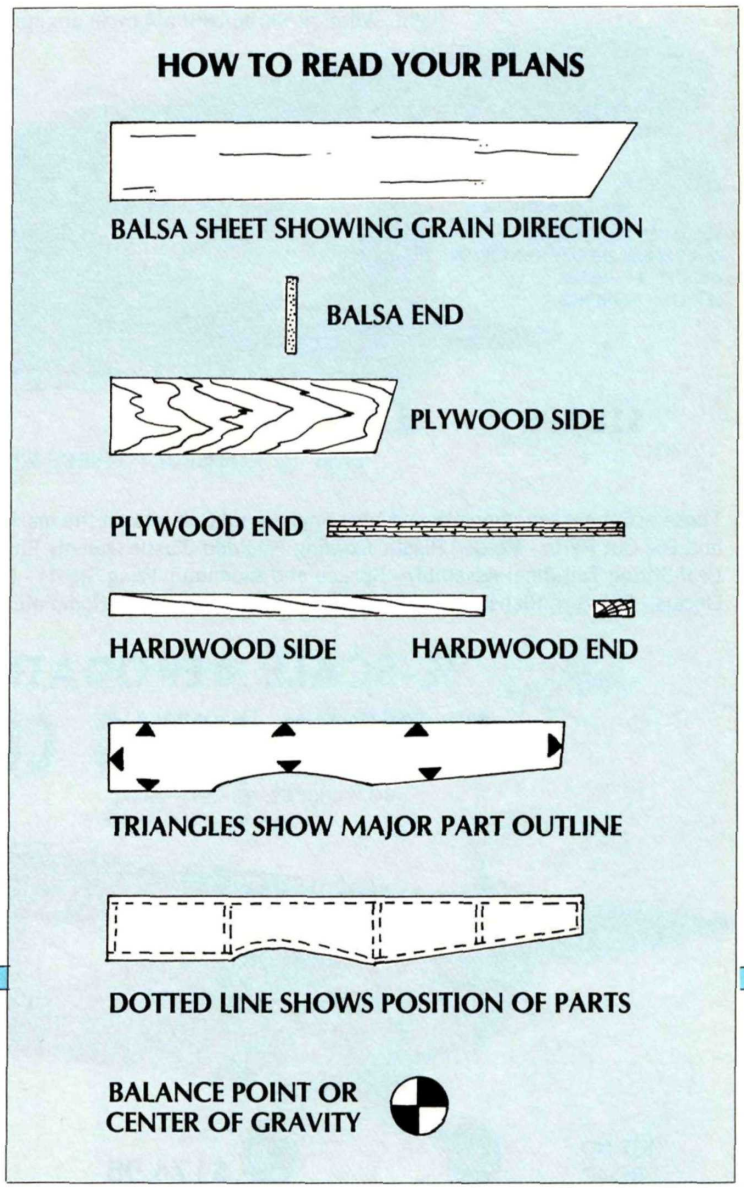
help you overcome those reservations with some basic guidelines. Once you try it, you'll be amazed at how simple it really is. You'll also gain much esteem and respect from your fellow modelers. But before selecting a model to build from scratch, let's get ready.

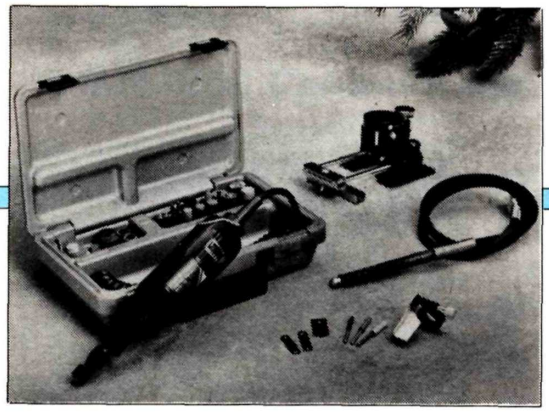
The primary tool for any scratch-builder is a flat working surface; a building board, if you will. For the majority of models, a door panel works great. I use a standard size door that is solid and has no holes drilled in it for the doorknob. The reason I use a solid door is because the hollow ones have a thin skin and pins don't stick as well to it. Also, solid doors are generally flat and won't warp as easily as the hollow kind.

(Continued on page 85)

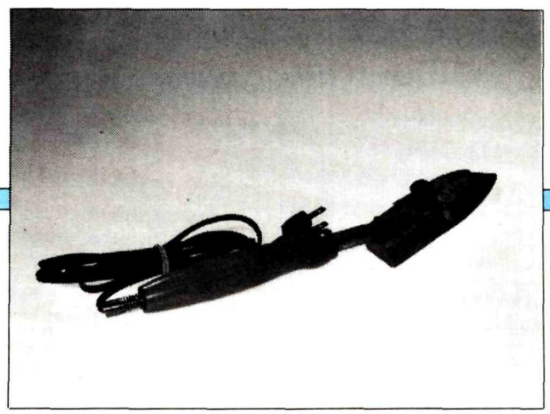


Extremely useful for the scratch-builder is the Dremel Table Saw and Belt Sander.

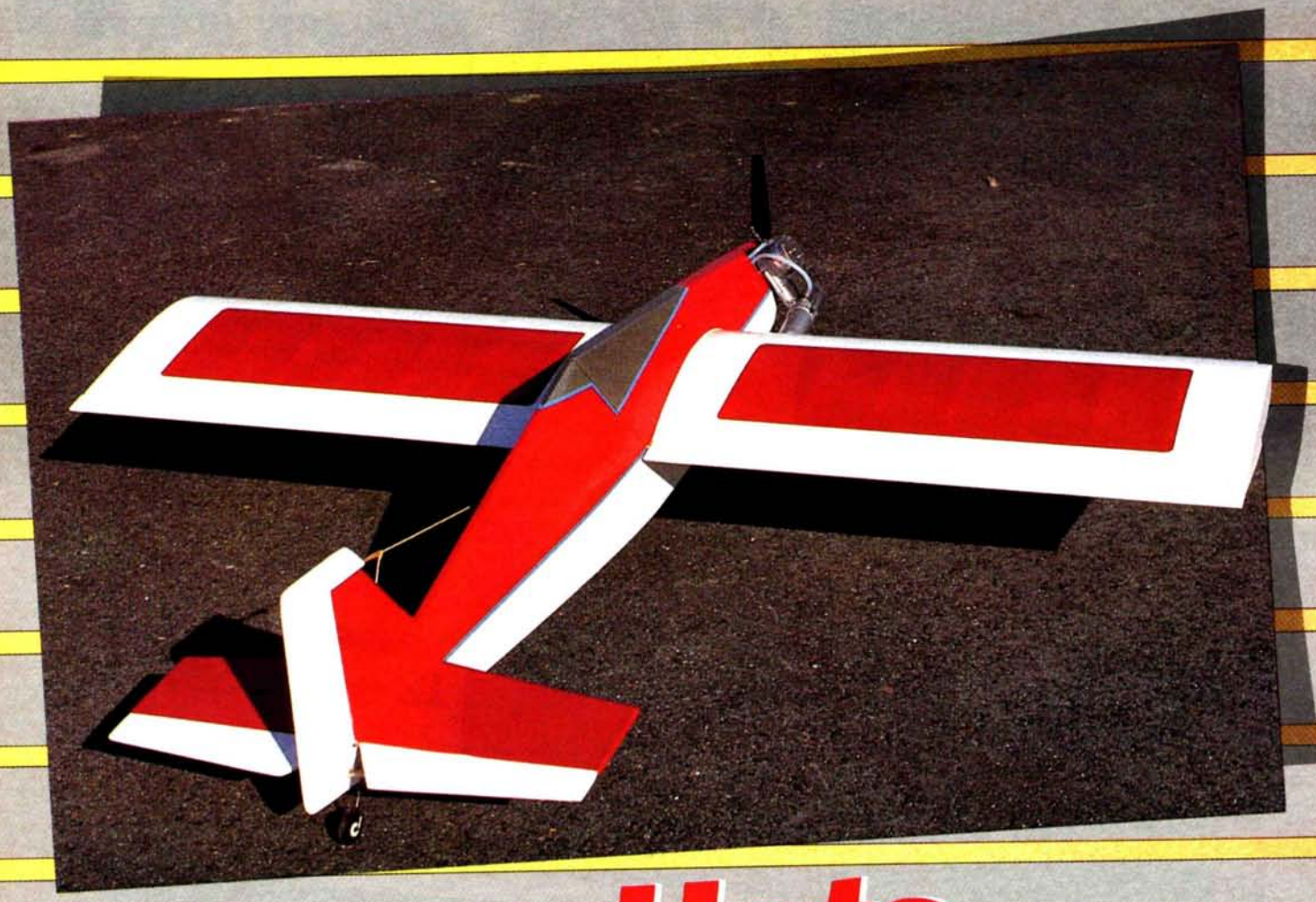




A small hand-held grinding and cutting tool is also a desirable addition to your workshop.



For applying heat-shrink covering to a model, a heat sealing iron is required.



Super Hots

from Midwest Products

by CHAUNCEY DANCE

IF SUCCESS CAN BE MEASURED in pleasure, Midwest Products Co.* of Hobart, Indiana, must be a happy bunch! In fact, they're even more so with their new Super Hots kit offering. And they should be. It's a great beginning to their new "Success Line," which is destined to set the standard by which all other kits will be judged. Believe me, Midwest did their homework on this one.

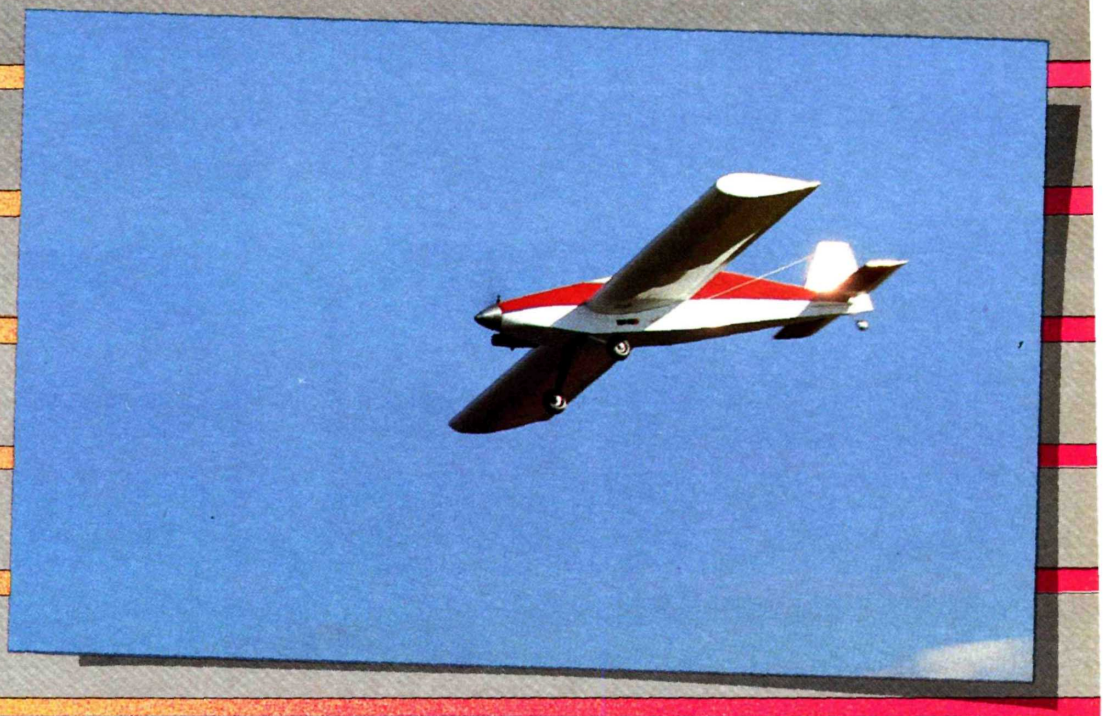
The Super Hots was designed by Dan Santich and was featured in the February 1986 *Model Airplane News*. Dan also designed the original Hots, which was so popular that Midwest picked up the option to kit it, and it remains a best seller. It was only natural for Midwest also to go with the Super Hots as a follow-up series to this winning design. The Hots has been so popular in fact that if you go to any fun fly in the country, you're bound to see a Hots, usually in the winner's circle. The thing that still amazes me is that Dan managed to put so much versatility into one design! Well, he's done it again with the Super Hots.

Dance fires up the Super Tigre for the maiden flight.

Having seen Dan fly his Super Hots at the various fun flys here in the East, I knew that as soon as the kit was released I was going to have one.

There are certain airplanes that stick with me because of a remarkable quality. Be it looks, performance, or a combination of both, the Super Hots has it

The Hots continues in this great new kit!

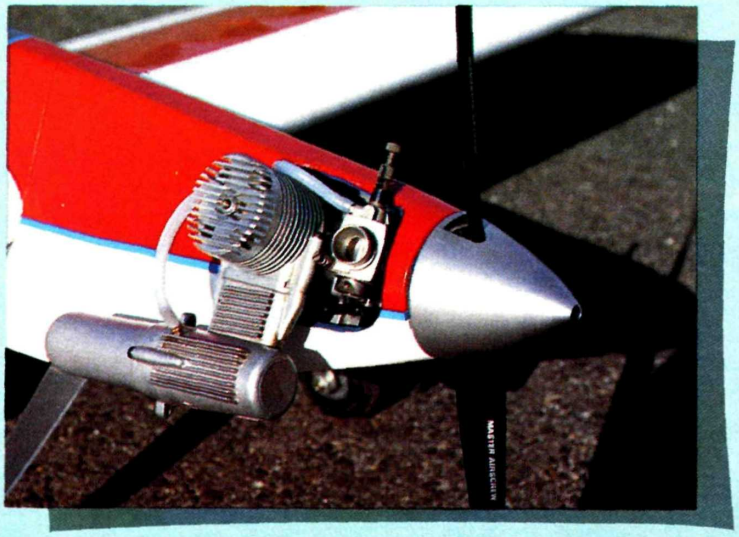


Type: *Sport*
Span: *54 inches*
Area: *702 square inches*
Length: *51 inches*
Weight: *5 pounds*
Engine: *ST 60*
Channels: *4*

all. The only reservation I had was that Dan's was a one-piece airplane, like the original Hots. Since I drive a small car, I was concerned about this until Dan told me that the Midwest kit would feature a removable wing. That did it for me, and I think I got hold of one of the first Super Hots kits to hit the East Coast.

THE KIT. Midwest has done a great job with this one! The wood is absolutely superb, the best I've seen. The plans are rolled and the artwork was obviously done by a real professional. Some kits have plans that look like 50-year-old newspapers stuck in the box. These, however, are not only beautiful but easy to understand. Top that off with an illustrated instruction booklet that guides you through each building step with check-off blocks, and you simply can't go wrong. It's so well planned that there's absolutely nothing left to guesswork. Each part is identified in the booklet and corresponds to the construction sequence that you're to follow—which I strongly recommend following.

CONSTRUCTION. Since it's inappropriate to reprint each step from the instruction booklet here, let me instead give you a few pointers. You start the project by assembling the wing, which is a very conventional style that goes together easily.

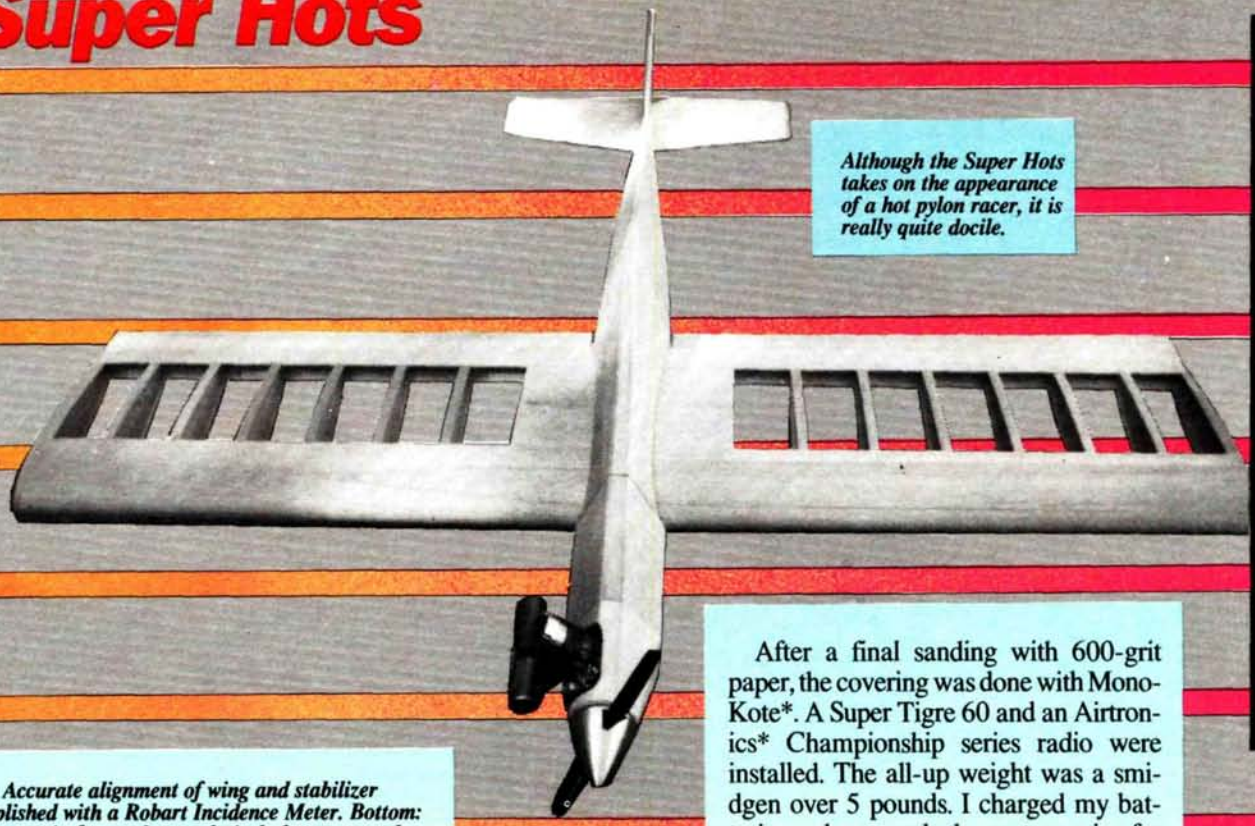


With Super Tigre 60 at a 45° cant, the muffler hugs the fuselage while also giving a much cleaner nose profile.

As I mentioned before, the wing is removable; it's attached by bolts that come up from the bottom of the fuselage.

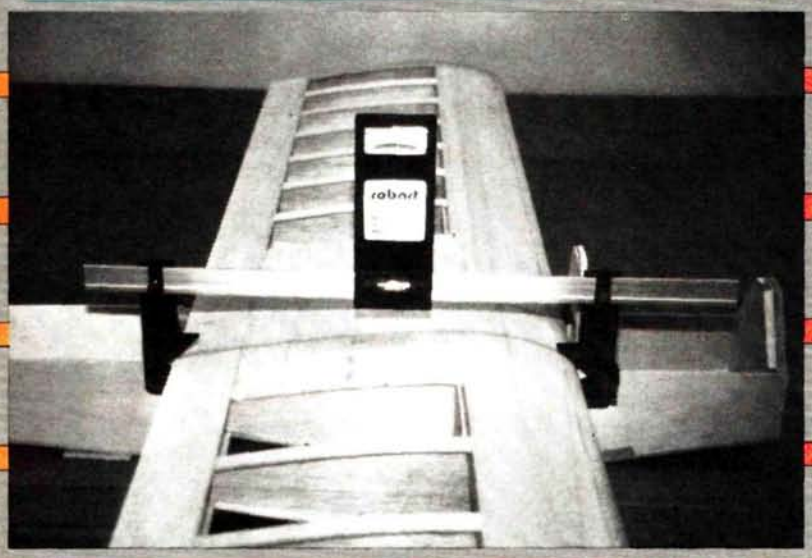
The fuselage is built by following the numbered steps in the instruction booklet and goes together quite fast. When mounting the tail feathers, be sure to check the alignment and incidence with a Robart meter.

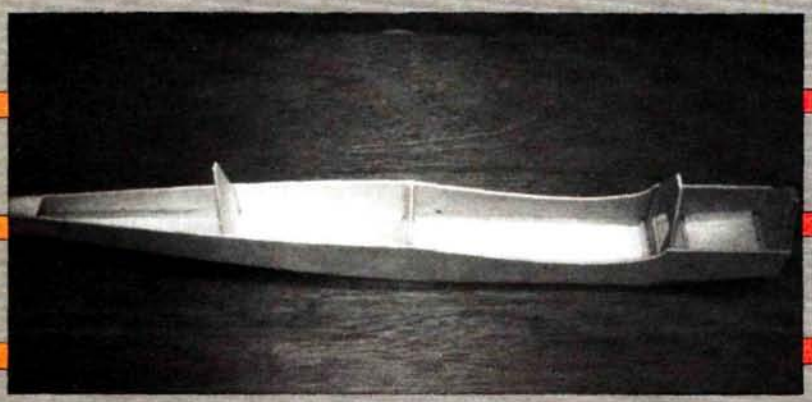
Super Hots



Although the Super Hots takes on the appearance of a hot pylon racer, it is really quite docile.

Below: Accurate alignment of wing and stabilizer accomplished with a Robart Incidence Meter. Bottom: Fuselage main frame shows relatively few parts and simplified assembly.





After a final sanding with 600-grit paper, the covering was done with MonoKote*. A Super Tigre 60 and an Airtronics* Championship series radio were installed. The all-up weight was a smidgen over 5 pounds. I charged my batteries and was ready the next morning for the maiden flight.

FLYING. Having built and flown a number of original Hots, I was ready for anything—a wild ride. But guess what? The Super Hots is a *pussycat!* It tracked straight down the runway and gently lifted off after only a short run at half throttle. The climb out was smooth and predictable. I circled around a little just to get the feel of the airplane and then went into some maneuvers. I found that due to the long tail moment all of the maneuvers went smoothly; and the plane was docile in its ability to change direction immediately upon command. It grooved perfectly through loops, rolls, spins, and inverted flight. Slow flight with this airplane was like a trainer's, probably due to its thick airfoil. But even at walking speed, all controls were 100% responsive.

All in all, I found the Midwest Super Hots to be a great kit and a fun-flying airplane. Midwest ought to be commended for the development of their new Success Line.

Good show Midwest!

**The following are the addresses of the companies mentioned in this article:*

Midwest Products Co., 400 S. Indiana St., P.O. Box 564, Hobart, IN 46342.

MonoKote is manufactured by Top Flite Models, Inc., 2635 South Wabash Ave., Chicago, IL 60616.

Airtronics Inc., 11 Autry, Irvine, CA 92718.■

TRAINERS

Basics of Radio Control

by RANDY RANDOLPH

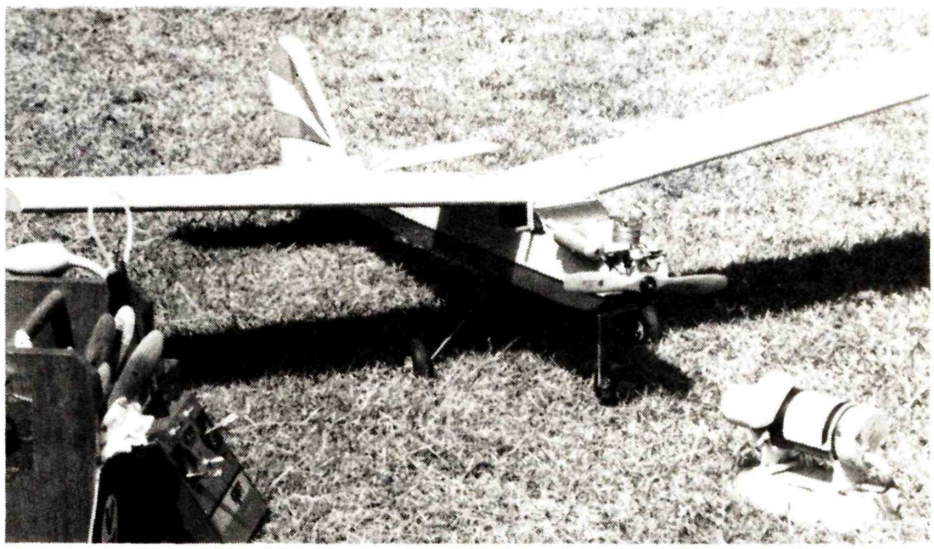
IN THIS series I've talked about the various parts of the radio system as well as some of the tools and equipment that are required in the shop. There were even a few words describing the way the controls affect the flight of an airplane, so it seems a good time to talk about the airplane itself.

If you ask the average R/Cer what he considers to be the best training airplane, nine times out of ten he'll describe the first airplane he could fly without that "sweaty-hands" feeling. It may not have been his first trainer, but it was the first airplane he could truly fly. That's a clue to what a trainer should be, it should be an airplane that becomes comfortable to fly.

Almost every manufacturer in the R/C model business offers a trainer. In a lot of cases the term is applied to any sport-type airplane! It's true that those kinds of airplanes can be used as trainers, but in many instances the term is used as a sales tool to describe a relatively uncomplicated airplane. This tells us that a trainer should be uncomplicated.

Some fliers keep their first airplane for years, but in the process of learning we must usually try something that is a little beyond our ability. Most of the time we get away with it and learn, but sometimes we don't! This gives us still another clue. The first trainer should be expendable, i.e., inexpensive!

So far it appears that the trainer should be an inexpensive, uncomplicated airplane with which the new flier can become comfortable in a relatively short time. But, there are other considerations.



A good example of a desirable trainer is the PT-20 from Great Planes Model Distributors. It is a high-wing three-channel machine that is properly powered for its size and wing loading.

Some of us are not blessed with perfect eyesight, so the size of the airplane is an important factor. People with good eyesight can see a small .049-powered airplane at 1,000 feet high with no trouble, while those of us who see the world through bifocals would be much more comfortable with a 6- or 7-footer at that altitude.

Besides size, color is important. I have a friend who completely covered a rather nice airplane with chrome MonoKote. Once in the air it disappeared against a cloudy sky. The next time it came to the field it had rather large areas trimmed in red and orange! There are color combinations that are much easier to see than others, the yellows, oranges, and reds, for example. Select a color scheme for your trainer because of its visibility rather than its beauty!

Now let's see about selecting that "comfortable" airplane. It should have a wing loading between 10 and 15 ounces per square foot of wing area. To get the wing area in square feet, multiply the

All trainers don't have to have a high wing. Low-wing airplanes also make excellent trainers if properly designed and set up.

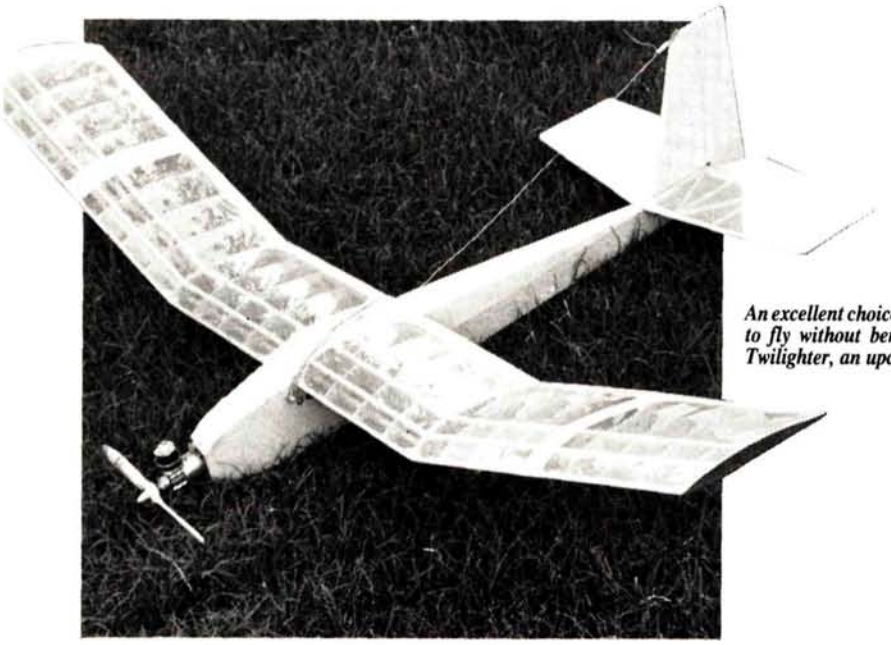
average width (chord) of the wing by the length (span). Since these measurements are usually given in inches, the results should be divided by 144 to arrive at square feet. Divide the weight of the airplane in ounces by the wing area in square feet and you have the wing loading. This is one way to anticipate the performance of an airplane!

Engine displacement to airplane weight should be near the following guidelines, with lower values even better: the .049s, up to 1½ pounds; .10 through .15, about 3 pounds; .20 to .30, up to 4 pounds; and the .40 to .60, 5 to 6 pounds. Compare these weights with the suggested wing loading figures above and you'll have a good idea of what to look for in an airplane. Most of the information you'll need is listed on kit box labels.

Please avoid complicated scale airplanes and radios with lots of additional features that tend to complicate the learning process. Although most hobby dealers are happy to help you, there are a few who will sell you almost anything to make a profit, or to move hard merchandise, and a $700 or $800 sale looks better to them than a satisfied long-time customer. The investment in a good engine, airplane, and four- to six-channel radio should cost no more than $300 to $400. The radio and engine, which are the most expensive, will last a long time and fly new models for years to come.

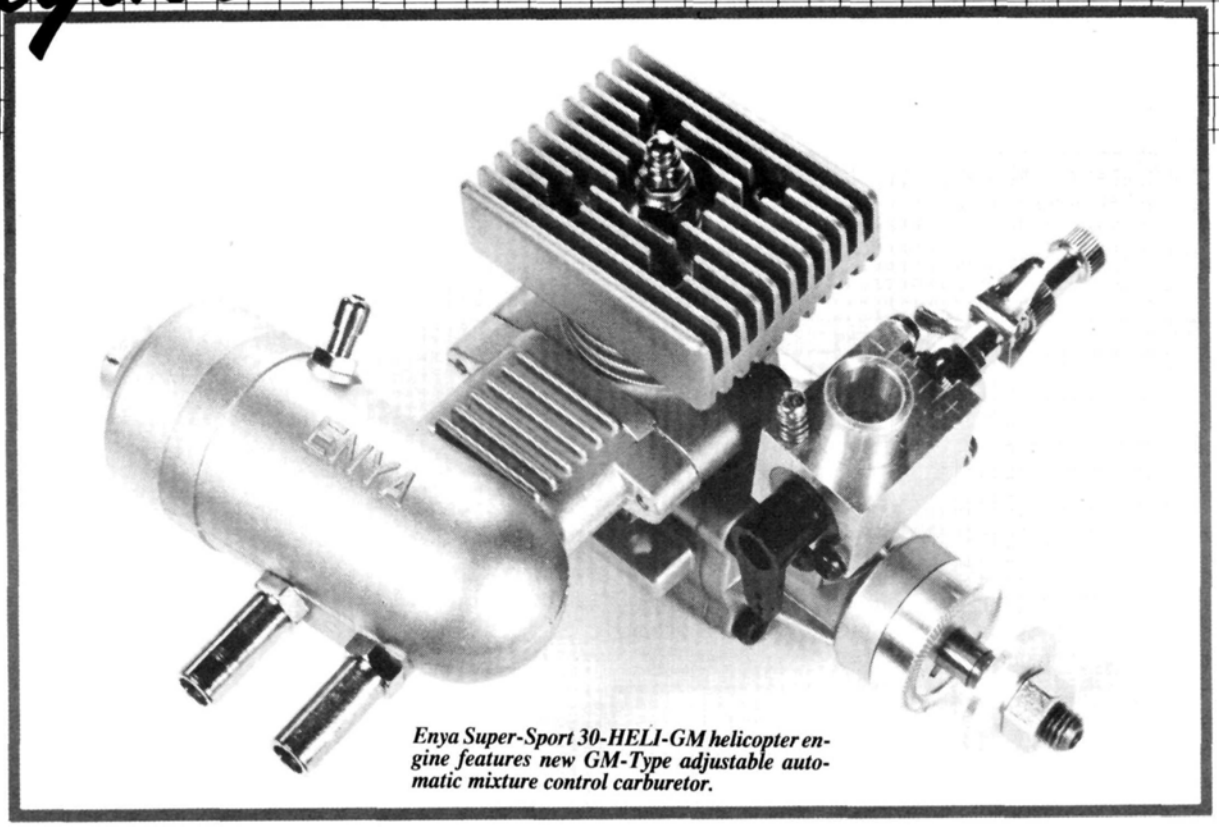
As we stated in the beginning, everyone has his own opinion of trainers, these are mine. The one thing that everyone agrees upon: get flight instruction! Your local R/C club is a good place to look for that instruction.

Randy Randolph, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■



An excellent choice for someone who must learn to fly without benefit of an instructor is the Twilighter, an upcoming M.A.N. design.

Engine Review Round-Up



Enya Super-Sport 30-HELI-GM helicopter engine features new GM-Type adjustable automatic mixture control carburetor.

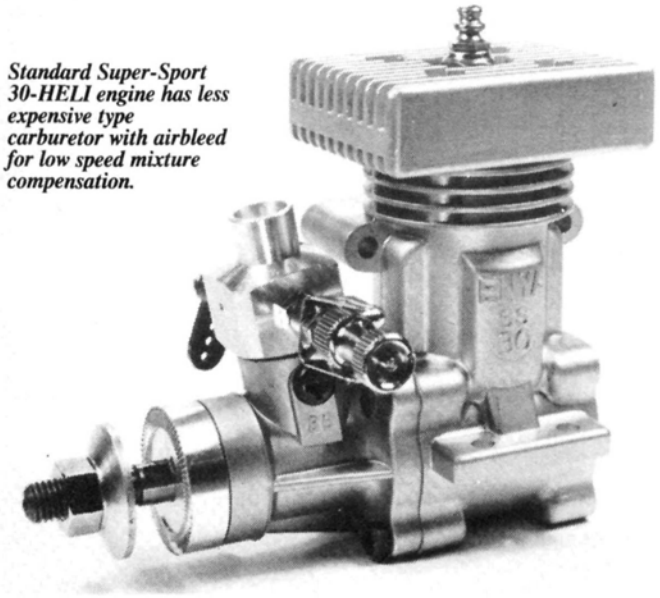
Enya Super-Sport 30-Heli & 30-Heli-GM

by PETER CHINN

Type: Air cooled, single-cylinder, side-exhaust two-stroke-cycle, with crankshaft rotary-valve and Schnuerle scavenging. Heat-sink type cylinder-head.
Bore: 19.0 mm (0.7480 in.)
Stroke: 17.0 mm (0.6693 in.)
Displacement: 4.820cc (0.2941 cu in.)
Nominal Compression Ratio (full stroke): 11:1
Speed Control: *30-HELI*—Enya standard airbleed type barrel-throttle carburetor with 5 mm choke; *30-HELI-GM*—Enya GM-Type barrel-throttle carburetor having adjustable automatic mixture control and 6.5 mm choke.
Checked Weight: *30-HELI*—233 grams (8.22 oz) bare, 284 grams (10.02 oz) with Enya M301-H muffler; *30-HELI-GM*—251 grams (8.85 oz) bare, 302 grams (10.65 oz) with Enya M301-H muffler.
Mounting Dimensions:
Crankcase width: 29.5 mm
Length from prop driver face: 74.0 mm
Height above CL (less glowplug): 58.3 mm
Bolt-hole spacing: 37.0x15.0 mm
Manufacturer's Claimed Power Output: *30-HELI*—0.6-0.75 PS less muffler, 0.5-0.65 with muffler; *30-HELI-GM*—0.7-0.85 PS less muffler, 0.6-0.75 with muffler.
Manufacturer: Enya Metal Products Co., Ltd., Nerima-ku, Tokyo 176, Japan.
U.S. Distributor: Altech Marketing, P.O. Box 286, Fords, NJ 08863.

SINCE ITS introduction earlier this year, the Enya "Super-Sport" series has been steadily expanding. As regular readers will know, two versions of the Super-Sport 25 were dealt with in the July 1986 *M.A.N.* and were followed by the Super-Sport 30 in its standard and ringed versions in the October Round-Up. Illustrated here are two 30 size helicopter engines and next in line are new larger Super-Sport engines in .40 to .50 cu in. displacements.

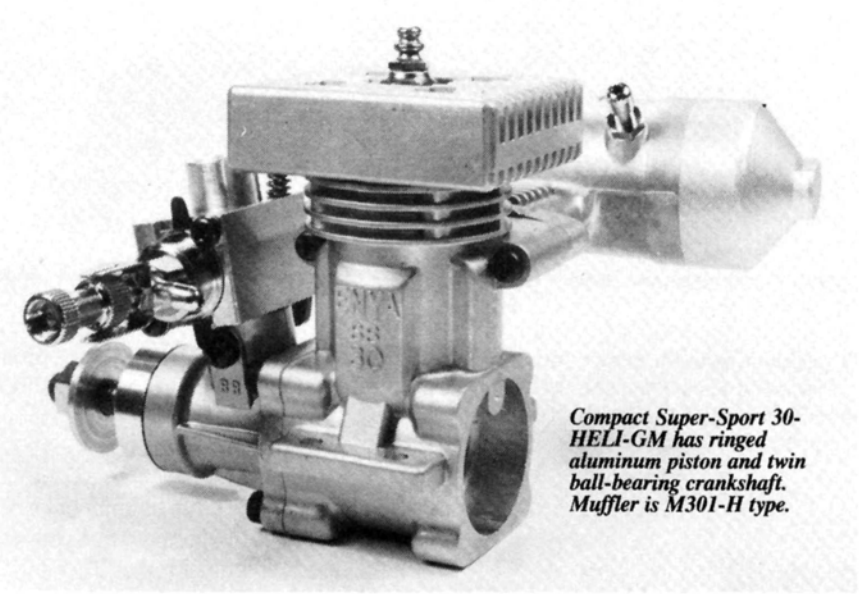
All the 25/30 motors look much the same from the outside and have the same mounting dimensions, but they incorporate many subtle differences enabling them to meet the requirements of both sport fliers and beginners. For example, the least expensive 25 model has the simplest type of barrel throttle carburetor and a small Enya M250 muffler, as well as a plain bronze bushed main bearing, whereas the more powerful ball-bearing equipped 25BB has an Enya G5.5 automatic mixture control carburetor and the larger M251 muffler. Both have a ringless cast iron piston running in a hardened steel cylinder sleeve, but the 25BB is also



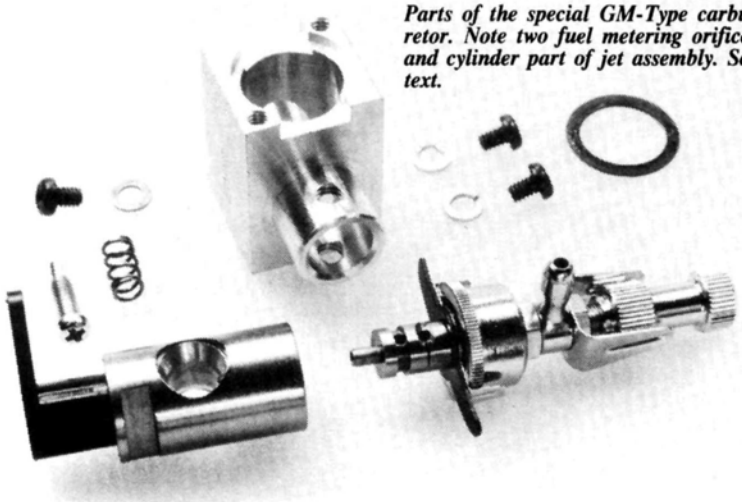
Standard Super-Sport 30-HELI engine has less expensive type carburetor with airbleed for low speed mixture compensation.

obtainable in a still more powerful variant, the 25 "Al-Chrome" model which has a ringless aluminum piston running in a chromed bore aluminum alloy liner. There is a similar group of three models in the larger displacement SS-30 range except that, in this case, the top model, designated 30-Ring, has a ringed aluminum piston running in a hardened steel liner in place of the Al-Chrome setup.

All six models, plus a helicopter engine, designated 30-HELI-GM, are listed on the single instruction sheet that has been issued with these engines, but there is also an eighth model not so listed. This new addition, identified simply as the Super-Sport 30-HELI, is basically the same as the HELI-GM, but has a standard airbleed type carburetor in place of the complex GM-Type.



Compact Super-Sport 30-HELI-GM has ringed aluminum piston and twin ball-bearing crankshaft. Muffler is M301-H type.



Parts of the special GM-Type carburetor. Note two fuel metering orifices and cylinder part of jet assembly. See text.

The GM-Type carburetor is described by the manufacturer as a "highly modified version of the G-Type." In fact, it is a good deal different from the G-Type, both in principle and in construction. These two carbs are similar only insofar as they both have the usual barrel type throttle valve, plus a built-in device for automatically restricting the amount of fuel released through the jet at reduced throttle openings. In the standard G-Type, the amount by which fuel flow is reduced, when the throttle is closed, is fixed. Any tendency for the engine to run rich, or lean, at idling speeds, is then corrected by means of an airbleed screw.

With the GM-Type, in contrast, the amount by which fuel flow is controlled at reduced speed is variable. There is no airbleed. Instead, the engine has what the maker calls a "medium speed mixture adjusting lever." This is used to rotate the jet assembly in a brass sleeve that is fixed concentrically within the throttle barrel. The jet assembly has a 6 mm diameter cylindrical portion (see photo) forming a valve that is a close fit within the brass sleeve. There are two radial holes in this

(Continued on page 90)

Engine Review Round-Up

by PETER CHINN

O.S. Max-61RF. ABC

All-new Max-61RF has lengthened stroke and modified porting for higher torque at reduced operating rpm, as now required by pattern fliers. Also good for scale.

Type: Air cooled, single-cylinder, rear-exhaust two-stroke-cycle, with crankshaft rotary-valve and Schnuerle scavenging.
Bore: 23.0 mm (0.9055 in.)
Stroke: 24.0 mm (0.9449 in.)
Displacement: 9.971cc (0.6085 cu in.)
Nominal Compression Ratio (full stroke): 11.8:1
Speed Control: O.S. Type 7L barrel-throttle carburetor with adjustable automatic mixture control.
Checked Weight: 535 grams (18.9 oz):
Mounting Dimensions:
Crankcase width: 42.0 mm
Length from prop driver face: 96.5 mm
Height above CL (less glowplug): 81.0 mm
Bolt-hole spacing: 52.0x25.0 mm
Manufacturer's Claimed Power Output: 1.85 bhp at 16,000 rpm.
Manufacturer: O.S. Engines Mfg. Co., Ltd. Higashisumiyoshi-ku, Osaka 546, Japan.
U.S. Distributor: Great Planes Model Distributors Company, P.O. Box 4021, Champaign, IL 61820.

Max-61RF has a rear exhaust. Also available is side-exhaust Max-61SF. Both engines obtainable in helicopter versions and/or with diaphragm fuel pump.

THE MAX-61RF.ABC is one of a new and extensive range of O.S. FAI 10cc (0.61 cu in.) class two-stroke-cycle engines which, it is expected, will eventually replace the 61FSR and 61VF range. The latter engines have been very successful over the years, but they have their origins in the Max-60FSR designed in 1974, whereas the new models have been developed to meet the changing requirements of modern high-performance international class contest models.

For example, the demands of the revised FAI aerobatics schedule and the need to reduce overall noise levels (prop as well as engine noise) have seen a swing toward the use of much coarser pitched propellers and substantially lower operating rpm. High-performance two-strokes have long had an abundance of top-end power that is impossible to use, simply because, to reach these high bhp peaking speeds would require inefficiently small props.

Robust one-piece case and Type 7C easy-to-adjust automatic mixture control carburetor are both new.

Unfortunately, in an internal combustion engine, the pursuit of the ultimate maximum power output inevitably brings with it higher operating speeds. So far as model applications are concerned, this can be an advantage for racing models, for ducted-fan use and for racing boats, but, for most R/C aircraft, only the use of a reduction gear between engine and prop will enable full aerodynamic use to be made of the engine's available power. To date, attempts to interest pattern fliers in geared engines have not been too successful. Gear boxes are ideal in that they allow virtually any sized prop to be used (given a suitable gear ratio) but they add about 50 percent to power unit weight and also increase both noise and fuel consumption.

There is a need, therefore, for engines that will produce more torque at lower rpm, even at the expense of some top-end power. So far as the new O.S. RF Series (rear exhaust) and their companion SF Series (side exhaust) engines are concerned, there is very little change in the peak bhp rating, compared with the FSR and VF models, but quite a sharp improvement in the power available at lower rpm has been achieved.

For example, in factory tests on the Max-61FSR.ABC versus the Max-61SF .ABC, the new engine produced 1.85 bhp at 16,000 rpm compared with just over 1.80 at 17,000 for the 61FSR. Above 17,000 rpm, the power of the new model fell off quicker than that of the older engine, but at lower speeds it was markedly better. Extrapolating torque values from these factory power curves, there appears to be something like 14 percent greater torque available at 10,000 rpm, nearly 11 percent at 11,000 rpm and about 9 percent at 12,000 rpm. The current trend in FAI world championship class aerobatics is to use props that hold rpm down to less than 11,000 rpm static, so the new engine's substantially better performance at these levels should be really useful. The news is equally good for FAI scale buffs who wish for more torque, low down, to turn the larger diameter props and achieve the higher takeoff thrust desirable for a 13-pound scale model.

Hefty crankshaft has 17 mm diameter main journal. Cylinder liner has extra thick wall and revised ports. Conrod is longer.

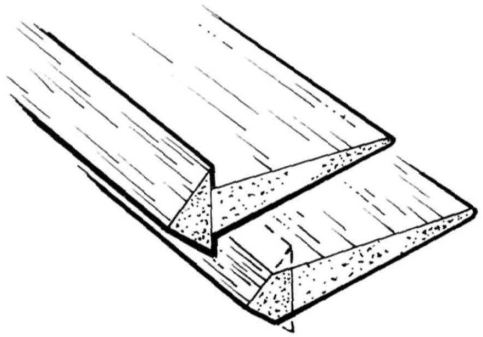
Although the 61SF and 61RF engines bear a family likeness to the 61FSR and 61VF, they are completely new models. First, it will be seen that, unlike all other 10cc size O.S. engines of the past twenty years, they no longer have a detachable front end. Instead, a one-piece body casting incorporating the crankcase, cylinder-block, front housing and, of course, intake boss, mounting lugs, etc., is used to achieve greater rigidity and improved support for the working parts. Although this means that damage to the case, or to just the front end, would involve replacement of the complete casting, the body, as a whole, is stronger and should be less susceptible to accidental damage.

(Continued on page 97)

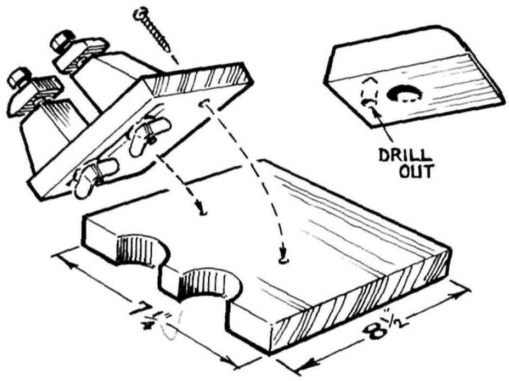
Hints & Kinks

by JIM NEWMAN

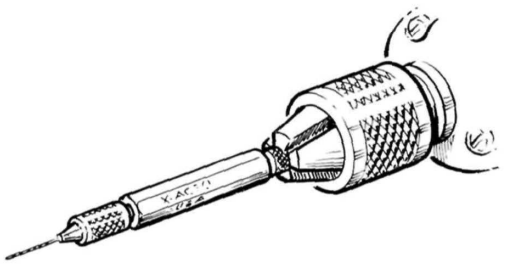
Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send rough sketch to Jim Newman, c/o **Model Airplane News,** 632 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.



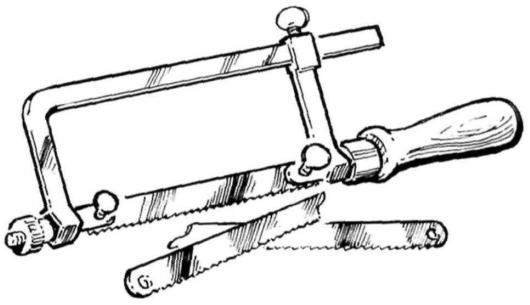
There are some who find that sanding the bevel on the leading edges of control surfaces is a difficult operation. Fear no more—this contributor has simplified the procedure by merely gluing triangle stock to the squared front edge of elevators, etc., then sanding the protruding pieces flush with the top and bottom. The sketch shows how simple it is! *Neal Saiki, Los Angeles, California*



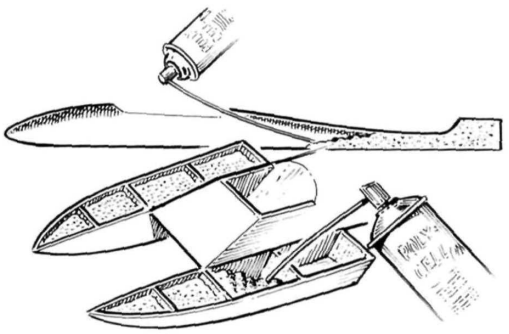
Some engine test stands have a disadvantage in that when mounting small engines the wing nuts interfere with the engine cylinder. The cure is to route or saw a recess in the edge of a piece of board, then invert the wing nuts and bolts. The recess provides clearance for the wings of the nut and the fingers. In addition, drilling into the underside of the upper clamping blocks allows them to clamp down over the steel pins so that small engines like the Tee Dee .049s can be securely clamped on their mounting lugs.
James Sparks, Glennellin, Alaska



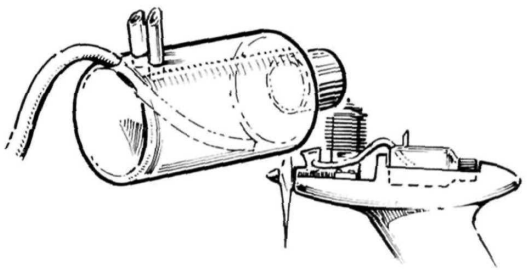
Very often the chuck of an electric drill will not close sufficiently to grip very small drill bits. The adaptation is to first mount the bit in a pin vise, then grip the pin vise in the jaws of the drill chuck. *Walter Allen, Flora, Indiana*



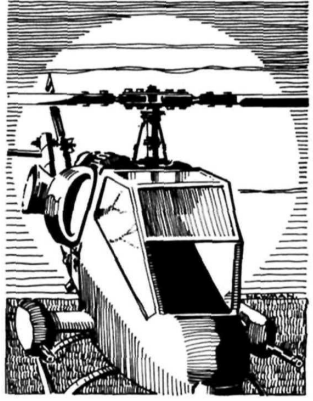
Save those broken hacksaw blades. The apparently useless pieces can be clamped into a jeweller's-saw frame to yield further useful service. *Eduardo Espejel, Toluca, Mexico*



The Air Force has found a way to stiffen those glass fiber fuselages and to build-in buoyancy on boats and floatplanes. Your hardware store has Polycell One—a pressurized can of foam sealant or caulk. Injected into cavities it foams to twice the original volume, then cures to a lightweight, rigid foam that adds stiffness and buoyancy.
Jack Miller, McGuire AFB, New Jersey



Small engines in glider power pods need a small, compact fuel tank, and such a tank can be adapted from a 0.6-fluid-ounce Liquid Paper Thinner bottle which is transparent and unaffected by raw fuel. Clean it out with alcohol and a cotton swab, make a gasket for the cap from soft plastic or gasket material, discard the dipper tube, drill holes to tightly fit the feed, fill, and vent tubes, then force silicone fuel line into those holes. Angle-cut the fill and vent tubes to face forward against siphoning, then glue the tank into the pod with its centerline level with the spray bar.
John Greenland, Herrliberg, Switzerland



Helicopter Cha

by CRAIG HATH

THIS MONTH, I'll go into some coverage of a few beginner kits, and touch on some basic definitions of what these kits offer. In an effort to keep this as unbiased as possible, I contacted a few of the top fliers around the country to get their opinions on what models are best suited to the beginner. If you don't see your particular model mentioned here, don't assume that you possess an inferior product, or that you own a model that's unacceptable for the fledgling pilot. As I've mentioned before, I feel that there's no "poor" helicopter kit on the market today. There simply isn't enough space or time to cover every possibility, so consequently I will only cover those models that seem to get the most mention.

As stated last month, I feel that the prerequisites for the first-time helicopter would be that the kit be purchased new or have all of the documentation for assembly with it, have readily accessible replacement parts, and be of a design that incorporates collective pitch. Keeping this in mind, let's explore a few possibilities that are listed not necessarily in the order of preference: the new Kalt Cyclone, the GMP Cobra, the Kavan Shark-40, the Kalt Baron 28, and the Hirobo Shuttle. These models have all the prerequisites and are a good value.

The Kalt Cyclone, a newcomer to the field of sport/beginner kits, is imported by Circus Hobbies*. This model features a nearly all-glass-filled nylon construction, a new high-tech smooth-belt tail-rotor drive system, a neat gyro mounting shelf, a mounting plate for switches, and antenna retainers on the main landing gear. The Cyclone won't cost a fortune, and is definitely a helicopter that will be easy to fly and maintain.

The GMP Cobra is also a popular sport helicopter. It has been well received by many modelers because it offers great performance at a good price. The Cobra is produced by Gorham Model Products* and is available through dealers all over the country. Most of the fliers I talked with recommended the Cobra be purchased as the basic Cobra kit with the stock rotor head, and noted that purchase of the autorotation system with the kit will save you a little money.

Autorotation refers to a maneuver that lands the helicopter safely in the event of a power failure. This is not easily accomplished by the beginning pilot, yet I feel that the addition of this system to any model helicopter has some benefit for the beginner. For example, the re-entry to hover from forward flight becomes a little easier with autorotation because the rotor speed won't drop as quickly due to mechanical drag, giving the helicopter a longer glide path and the pilot more time to respond to the controls.

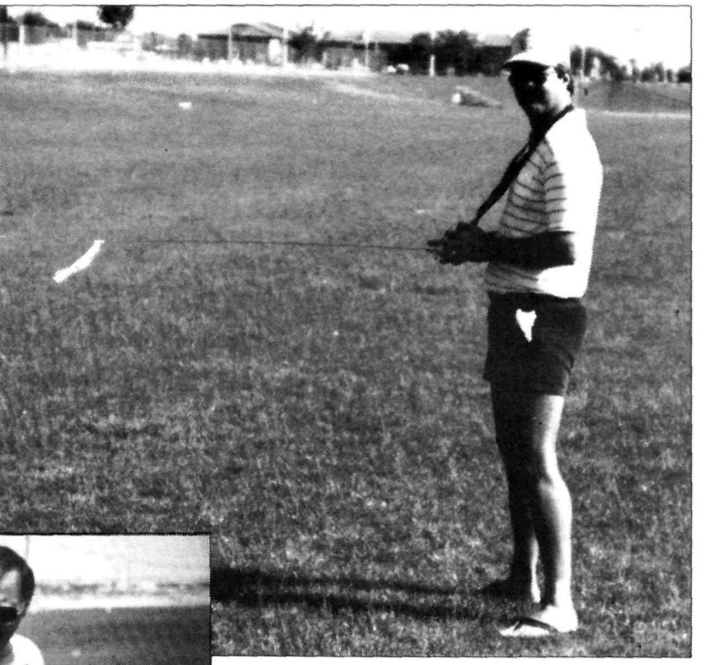
Finally, the Cobra is capable as a competition helicopter as evidenced by its list of contest wins. One of the big advantages to the Cobra is that it has a strong following and it should not be difficult to find people who can help with technical support, and advice.

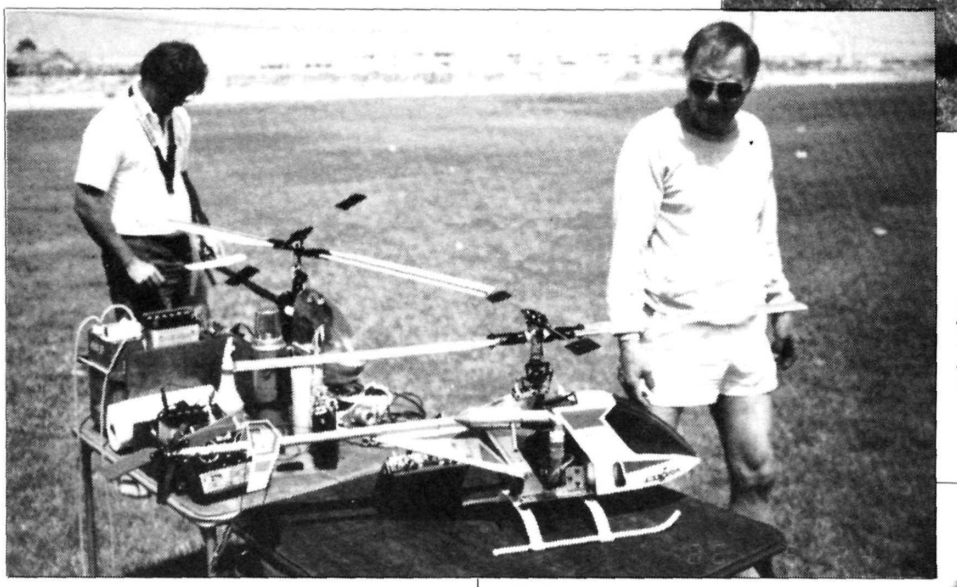
The next model on the list is the new Kavan Shark-40 from Hobby Shack*. The Shark is available in two versions, one with collective pitch, and the other in the fixed-pitch version. I'll stick to my recommendation that you buy a collective-pitch helicopter because of the much quicker throttle/collective response. See Dr. David Trost's column, "The Basics of R/C Helicopters" in the August 1986 *M.A.N.* for an in-depth explanation of fixed- and collective-pitch control.

The Shark includes autorotation as standard equipment and features a new collective-pitch control system called BLSC (ball liner slide control) which provides smooth in-line pitch control for collective along with Bell-Hiller mixing. This is accomplished by moving the

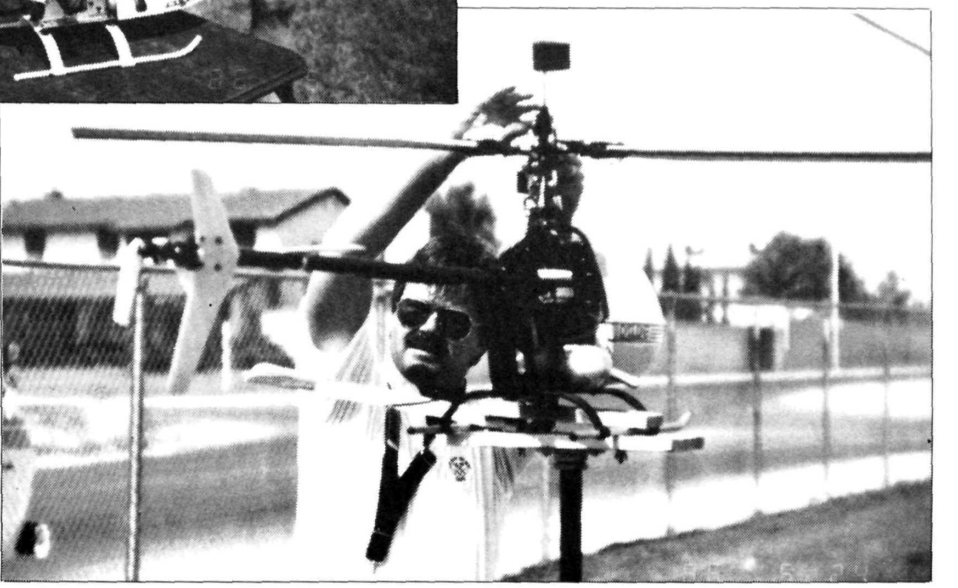
Above: The Circus Kalt Baron .28 with whiffle balls makes an excellent trainer. Right: Toni Bonnetti of Circus Hobbies checks out the Kalt Cyclone which Circus imports. Far right: The GMP Cobra offers outstanding performance at a reasonable price. Here flown by Tom Hart.

The GMP Cobra has a bag full of tricks to offer.





Above: Author Hath demonstrates his pleasure in flying a well-trimmed helicopter. Left: A well-prepared flier brings all of the necessities to the flying field. Below: Dick Meeker built this handy run-up stand, which is very useful for engine tuning and setting the main rotor pitch.



servos on a sliding servo tray.

The construction of the Shark is mostly wood and plastic with many sub-assemblies already completed, like rotor head and main shaft assemblies.

The Kalt Baron .28 is the fourth model listed, and might be the most popular model among beginners and the sport crowd. The Baron .28, also imported by Circus Hobbies, has been around for about 7 years, and was originally called the Baron .20, which was updated to the Baron .28 about two years ago. The name-change reflected a more accurate

(Continued on page 38)

HELICOPTERS

(Continued from page 37)

description of the model since it uses a .25-.29 engine. Because this model is smaller than the first three models, it represents a savings in replacement parts, and in storage space. But the size will cost you a slight loss of stability.

The Baron .28 comes with a Hiller-only steering system as standard equipment, which really makes rotor-head steering easier for the beginner because the controls are less responsive. Hiller steering refers to a system of rotor steering control which operates by changing angle of attack of the stabilizer paddles only, and doesn't immediately change rotor blade pitch—sort of a system of forcing the rotor disc to change direction.

The Baron is a collective-pitch machine and has an optional spare parts kit available which contains some of the most likely to be damaged replacement parts.

The construction of the Baron .28 is much like the Cobra in that it is mostly metal; however, the Baron .28 comes with the rotor head assembled at the factory. One of the nice things about the Baron .28 is that it's very simple for a

(Continued on page 50)

Hobby Shack

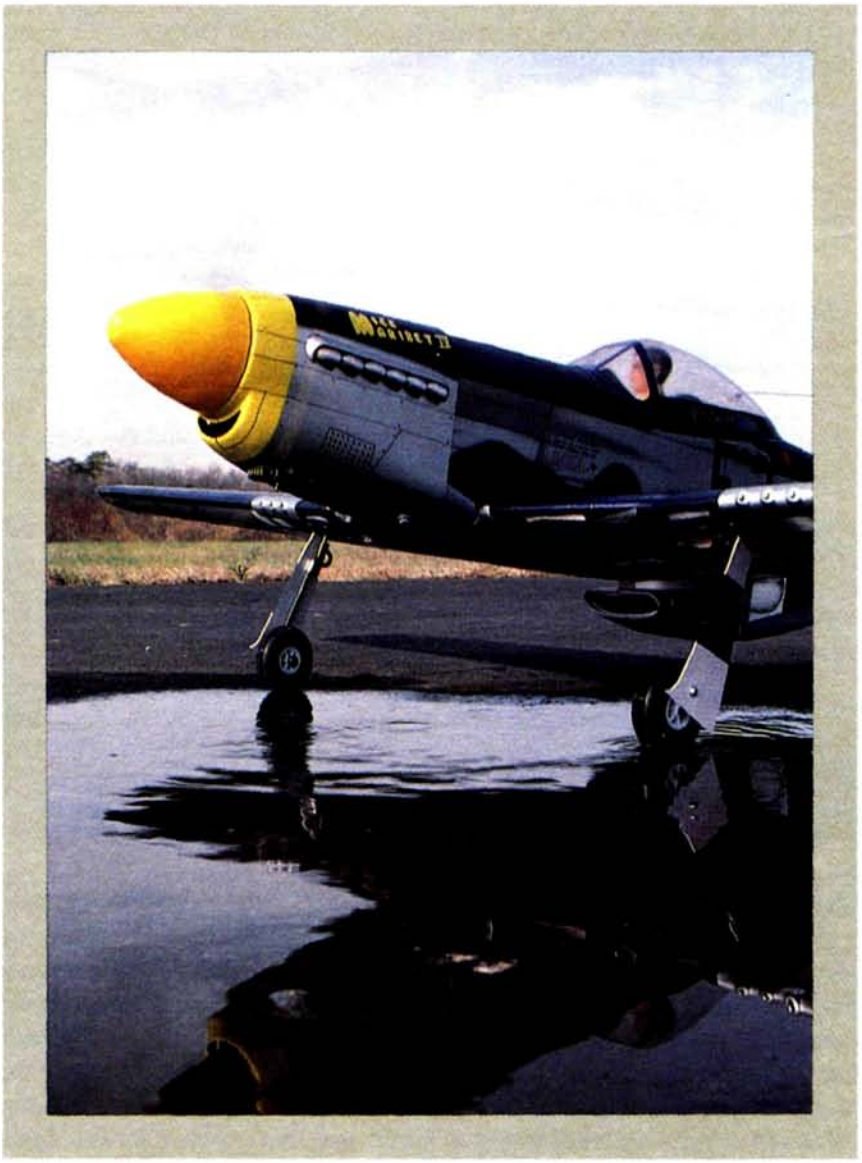
P-51 Mustang

by RICH URAVITCH

Sport scale was never so EZ!

JUST what the modeling world needs, right? Another P-51 Mustang! I guess I've built at least one of every R/C Mustang kit ever released and two or three of some of them. One might ask, why another? It's simply one of the most popular, slickest fighters ever, and that means nearly everyone can live out a fantasy, complete with helmet, goggles, and white scarf, by owning one. Mustangs sell.

So what's new about this one? Everything, from its unique engineering design to its exciting execution. This newest member of the Hobby Shack* EZ line seems sure to please a broad segment of the modeling public. It satisfies the need of the modeler who would like to be flying a *recognizable* airplane but simply doesn't have the time or inclination to build one, or the builder who needs something to maintain flying currency while producing that "masterpiece."



THE KIT. The EZ Mustang continues the innovative manufacturing process of its predecessors—like the Laser, Decathlon, CAP 21, and most recently the FW-190 (see the Field & Bench Review by Chris Chianelli in the November '86 *M.A.N.*—by using a balsa or lite-ply structure to which is added a pre-decorated, fuel-proof ⅛-inch foam skin. Some of the other parts are vacuum-formed plastic with molded-in colors which generally match the adjacent structure. There is nothing to build, only the assembly of the components. Virtually all the hardware, such as the fuel tank, spinner, clevises, wheels, pushrods, and even epoxy, is included. You'll need to add Pacer's* Zap for building, an engine, a prop, and a radio. For their completeness, it's hard to beat the value of these kits!

ASSEMBLY. Assembly of the Mustang took just about five evenings (12 to 15 hours) with one of those devoted to the challenging installation of the retracts. The photo-illustrated construction manual is adequate, but a few small points might help you assemble yours, so I'll break them down, following the assembly sequence in the manual.

The wing parts list identifies "wing joiners" A and B (the illustration calls them "dihedral braces") and you should remember that joiner B is balsa. The rest of the wing assembly is a piece of cake; just test-fit pieces before epoxying. At the fuselage there's nothing complicated. By personal preference I chose to use nylon wing hold-down bolts rather than the kit-supplied metal screws with blind nuts. While doing this, I added two additional hardwood blocks to the mount plate which was cut flush with the wing saddle and then tapped 8-32.

Next come the retracts, which, as I mentioned earlier, were a challenge. The smart move is to order the retracts when you order the kit. They're called "Super 60 Class" and the Mustang is

Type: *Sport Scale*
Wingspan: *55.5 inches*
Wing Area: *542.5 square inches*
Engine: *.40-.45 two-cycle*
.60-.90 four-cycle
Channels: *4-5*
Weight: *6.5 pounds*

designed around them. They're mechanical, of excellent quality, and work well when properly tuned, i.e., linkage throws and bends are accurate.

You'll also need a retract (180°) servo that will work with the radio you're using. My choice was Airtronics* and I'm not disappointed: this servo has plenty of smash (54 inch-ounces), brass drive-gears, and seems to be up to the job. The actuating pushrods are really a cut, bend, and try effort and perseverance is in order, but once you get it, they work every time. Incidentally, the hole in the wing-top center-section cover is enough to get the servo in and that's all. You'll need to open it to get the linkages to work properly. One other thing, unless you *always* fly from a smooth, prepared runway, or on the landings you're a "grease it on" pilot, add some reinforcement in the form of blocks or Pacer's Zap-A-Gap fillets between the gear mount-plate and the visible portions of the wing ribs. This beefing-up will help in the long run.

I used a three-line system on my fuel tank rather than the illustrated two-line. This allows me to refuel without disconnecting the engine feed line every time (which can be a nuisance with cowled engines).

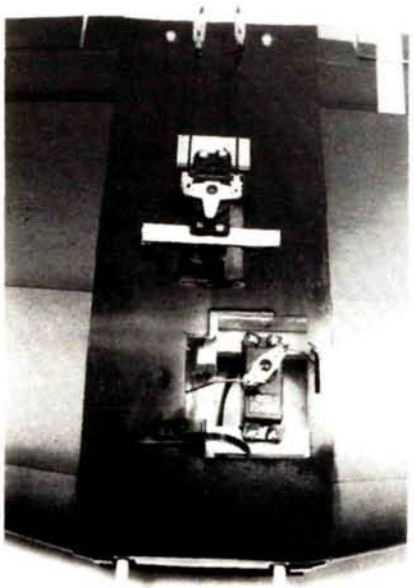
My Mustang was originally flown with an HP .61 two-stroke, which I then replaced with an O.S. 90 four-stroke from Great Planes Model Distributors* for comparison. Brother Chianelli was so impressed with the O.S. in his FW-190, I decided to try one. If *he* can make it work, anyone can! The engine mount system makes engine swaps easy. I did need to shim the engine ⅛-inch with ply, to make the crankshaft centerline exit the cowl in the proper location.

The tail group installation is straightforward. The only thing to be careful of here is when setting the fin in position, make certain it lines up vertically with the end of the fuselage. This will put the hinge (rudder) line where it belongs, with no gaps. However, before doing *any* of this, do yourself a favor and

install the elevator and rudder pushrods *before* closing up the stabilizer platform. The pushrod installation method described in the assembly manual will probably work, but I'm sure it will take more time.

I used my Airtronics six-channel radio in the Mustang and there was plenty of room for everything. As with most EZ kits, two servo trays are provided: one, for lighter two-cycle engine use, positions the servos forward; the other, for four-cycle use, positions them aft—a nice touch for better CG control.

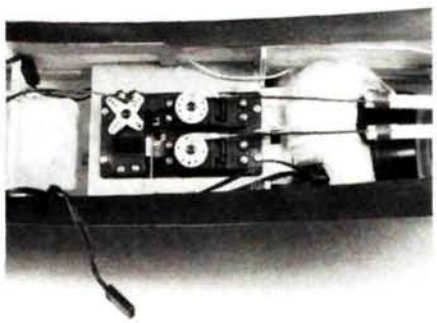
That concludes the basic assembly. From here on out it's a matter of personal touches. I added a pilot (Chianelli didn't) and my wife's name (Chianelli didn't) so my airplane not only looks more realistic, but I can go fly it whenever I want!



Lower servo is for retracts, upper for ailerons.

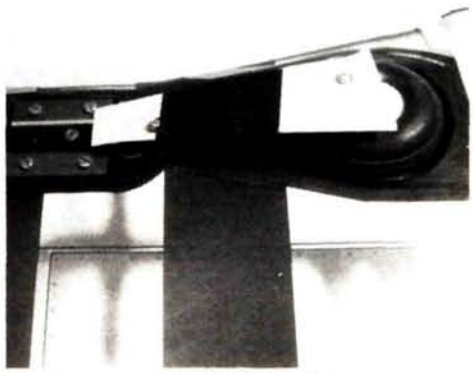
FLYING. I didn't get the '51 on its first flight—or second, third, or fourth. I did, however, wrestle my transmitter from Nick Ziroli and flew it on its fifth flight. Flights one through four were spent pitting Nick Sr. and Nick Jr., flying an EZ FW-190, against each other in mock combat while I shot video. I won't tell you the outcome—yet!

The Mustang is responsive, very smooth, and even docile. It performs well and won't bite you. I'm sure it could be



Control setup is conventional. Note nyrod for antenna guide.

flown by anyone with some solid low-wing, aileron time. At 6½ pounds, the wing loading is a comfortable 26.5 ounces per square foot, which puts it right there in the sport flier category. While I could go on to say how well it loops, rolls, stall turns, and flies inverted, all of that pales when you see this hummer rocketing along, gear up, 10 feet above the runway centerline at full throttle. Like I said earlier, it's the reason we buy so many Mustangs! The big advantage to this Mustang is that it allows you to experience the fantasy within a week of opening the box!

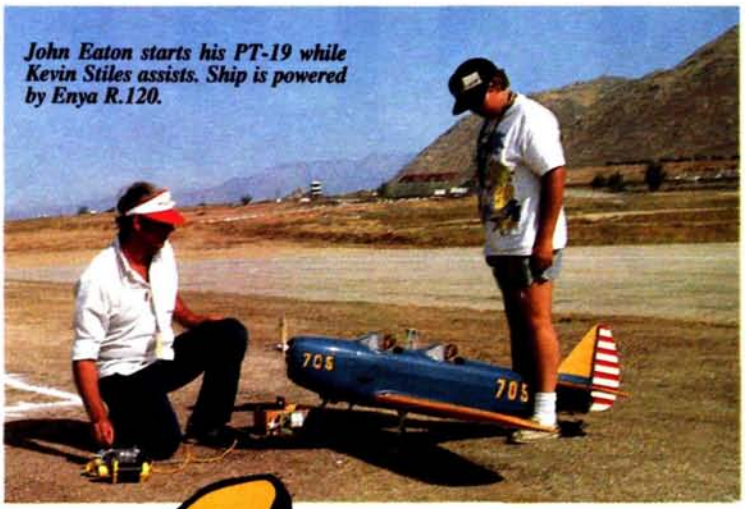


Retracts in up and locked position.

After re-engining with the O.S. 90 four-stroke, the flying qualities remained pretty much unchanged except it seemed to take a bit more elevator on landing flare due to the slightly heavier weight of the four-stroke. I suppose you could add a little weight to the tail, but I don't like to do that unless absolutely necessary. The 13x6 prop hauls it around with authority, but when it comes to engines, the choice is really yours. To answer your question—yes, the O.S. runs, and starts, just fine when mounted inverted. Just be aware that too much choking could cause hydraulic lock and damage the engine.

One thing I must point out that probably only guys like me who are accustomed to scale will appreciate is that the canopy is one of the most accurate (contour-wise) I've seen. The canopy portion actually bulges out properly past the windshield bow, and the cowl even has the characteristically flat upper forward section. I still appreciate touches of purism.

(Continued on page 113)



John Eaton starts his PT-19 while Kevin Stiles assists. Ship is powered by Enya R.120.

4-Stroke Scale Contest

by MIKE LEE and ELOY MAREZ

THERE'S NO DOUBT that the four-stroke model engine is well established and a permanent part of modeling. Go to any flying field and you can stir up an hour's conversation on four-strokes.

Celebrating the excitement and uniqueness of the four-stroke, the Riverside R/C club and Hobby Shack* have been hosting a number of contests dedicated to these little mechanical wonders. This year was their 5th annual effort, combining the four-stroke motors with standoff-scale competition.

This year's event was held on June 28 and 29 at the famous Riverside Raceway, home of great car races and the Riverside R/C club. The club provided the planning and manpower while Paul Bender, Mr. Hobby Shack himself, supplied sponsorship and even champ T. Yoshioka of Japan and the current champ, Hanno Prettner of Austria. The presence of these two gentlemen was reason enough for this pilot to attend, but Paul made things even more enticing with over $10,000 worth of prizes!

Mike Morrison's Laser from the Roush kit was powered by Saito and weighed 19¾ pounds.

Powered by an O.S. 2.40, Ralph Knight built this Gee Bee Senior Sportster from Haffke plans.

Opening day offered excellent flying weather as over 50 pilots and 100 aircraft took to the morning air. Scale aircraft of all types and construction were present. We saw everything from beautiful ¼-scale ships to ARF sportsters. They all shared the air in this low-key event.

Judging was done according to AMA standoff-scale rules. Static judging took place first thing in the morning on both days from a standard 15-foot circle. Flying soon followed along three orderly flight lines. The runway here was very good but not overly expansive—a few planes overshot into the dirt. Houses bordered the eastern side, but with these pleasantly tuned engines, the residents never knew the contest was on.

About noontime, flying stopped while Prettner and Yoshioka presented flying demonstrations for the crowd. An amazing variety of Hobby Shack EZ aircraft were flown by both pilots, including reproductions of both pilots' own main pattern designs. Prettner flew two versions of his Supra-Fly while Yoshioka flew his Dash 5-45. Both planes were impressive. Even more impressive were two EZ FW 190-scale birds flown by the two world-class pilots in formation, although neither pilot had ever flown these planes before.

Hanno also performed a couple of solo flights using the EZ birds, with his Supra-Fly model doing unbelievable stunts. Whoever thought that an ARF aircraft could do perfect flat spins, knife-edge loops, lomcevaks, and incredible nameless maneuvers that defied gravity! Hanno made it look easy and fun.

Hanno Prettner, left, and T. Yoshioka, right, fly formation as Takamatsu, center, calls maneuvers.

Flying filled the rest of the day, with judges racking up the flying points for the contestants. Two categories were to be judged: regular AMA standoff-scale and team scale. The split between the two events was pretty even. Some more outstanding aircraft included a gorgeous Laser 200 in the red Bud Light color scheme by Mike Morrison. Powered by a Saito 240, the ship flew very realistically with no lack of power. Unfortunately, the ship was heavily damaged on a stalled approach. Jerry Kitchen brought a nice ME-109 from a Royal kit powered by an O.S. 120. His was one of only two warbirds to appear at the event.

Bob Richards took the second-highest static score of the meet with a great Waco YMF-6. Bob flew it nicely. Ralph Knight had Ron Dickson pilot his superb GEE-BEE Sr. Sportster, powered with an O.S. 240. Built from Harry Hafke plans, the ship weighed 20 pounds.

On Sunday, the same itinerary was used. Hanno and Yoshioka again entertained the noontime crowd, which was substantial. I must admit, though, that many of the spectators and pilots were distracted by the tons of prizes piled on top of four tables to be given away!—a color television, microwave oven, radios, and just piles of aircraft kits. Paul Bender announced that no pilot would walk away without a prize. And amazingly, most walked away with at least two.

In the end, Jim McDonald took first-place honors with his beautiful Culver Dart. Second place went to Don Westergren flying a Lee Richards III aircraft. Third place went to Jerry Kitchen with his warbird. In the team scale event, the top team was Ron Dickson and Ralph Knight in the Gee-Bee Sr. Sportster. Second place was captured by Bob McClung and Ron Innes flying a Nieuport 28 bipe, and Mel Santmeyer and D. Clarkson won third in the venerable J-3 club.

Top: Mike Morrison adjusts his engine. Bottom: Bob Richards took second in static with his WACO YMF-6.

Above: Second in Team Scale with a Nieuport 28 were Bob Innes and Bob McClung. Below: First in AMA Stand-Off Scale was Jim McDonald's Culver Dart.

Like I said, everyone received a prize for being there, including the helpers and judges. I even walked away with a Hobby Shack EZ chair—just for taking the photos!

Our hats off to the Riverside R/C Club and to Paul Bender for knowing how to make a contest a party! Good people, good modeling, and good flying topped with outstanding demos and the promise of something for your efforts, added up to an event that you can't afford to miss next time.

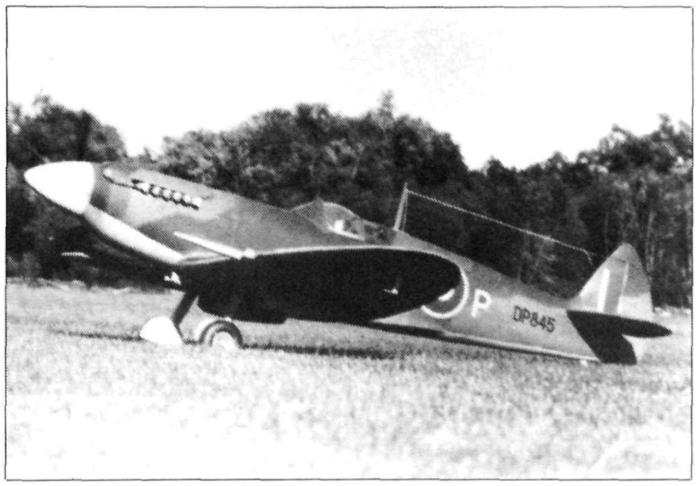
**The following is the name of the company mentioned in this article:*

Hobby Shack, 18480 Bandilier Circle, Dept CA086, Fountain Valley, CA 92728-8610. ■

Giant Steps

by DICK PHILLIPS

Quarter-scale Spitfire, new kit by Clark Airscrew. Model is large, impressive, and flies very well.



The Clark Spitfire is very complete, more in text.

I HAVE A couple of interesting things this month. One I've mentioned before as being in the works and now it's here. Clark Airscrew*, the Canadian propeller maker, has produced a quarter-scale Spitfire which will be available by the time you read this.

A quarter-scale Spitfire is a large model and a very impressive one. It has already been to the 1986 Battle of Britain reunion and aroused a good deal of interest there. That it is a true rendering of the Spit has been attested to by the admiration of some of the people who flew the full-scale version during the Battle of Britain.

This is a very complete kit, including the engine and retract gear. The engine is a pair of in-line Q50s driving through the same shaft. I'm told that it's a most impressive performer and that it moves this big bird with authority. Almost everything required to build the model, except for the glue and paint, is in the kit. The retracts were specifically designed for the model and are very true to scale.

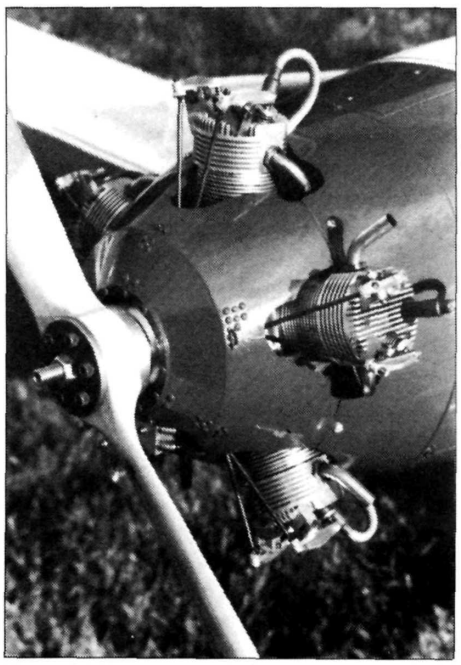
John Clark of Clark Airscrew is a perfectionist and the time required to get this kit to market has been caused by his refusal to turn out anything with which he is not completely happy. The kit should be a good one.

This kind of quality doesn't come cheap, of course. The cost of the kit is $2,000 (Canadian) but should be considered a bargain due to the completeness of the kit. The price is an introductory one and will be good until December 31, 1986. After that, about another $300 will be required to obtain one of these beauties.

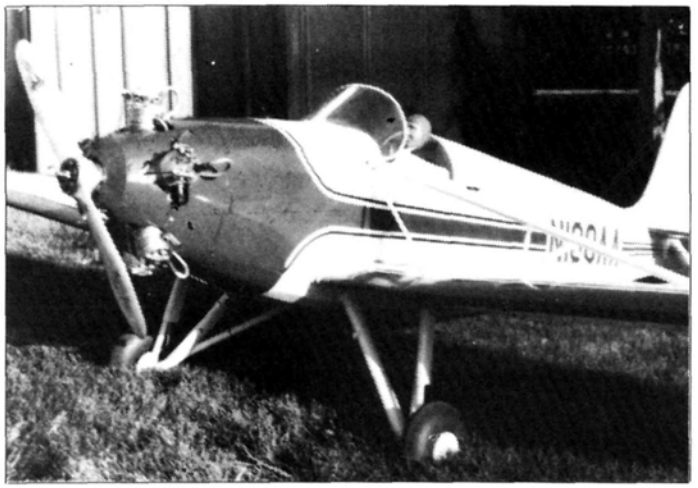
All From Scratch

The other interesting item this month is a model engine built by one of the modelers in my area. This young fellow, Dave Pape, has shown himself to be a very dedicated and capable builder. He's built a Kinner Model K Sportster from the DGA* plan and done an outstanding job of it. Not content with just building this excellent model, Dave built the engine for it as well. You can appreciate the effort that went into such a project. The proof of the pudding is that the model flies extremely well on the engine and it looks great. The Model K has been entered in a couple of contests (Dave's first) and has done very well indeed, as might be expected.

The engine was built from Forest Edwards'* plans and is little short of a work of art. Not content with duplicating Forest's efforts, Dave converted the engine to ignition, and designed and produced the ignition system himself—no small feat of engineering. He began construction of the engine in September '83 and completed it in February '84. Not a bad effort for six-month's work!



Edwards' 5-cylinder radial on ignition used to power Kinner Sportster by Dave Pape.

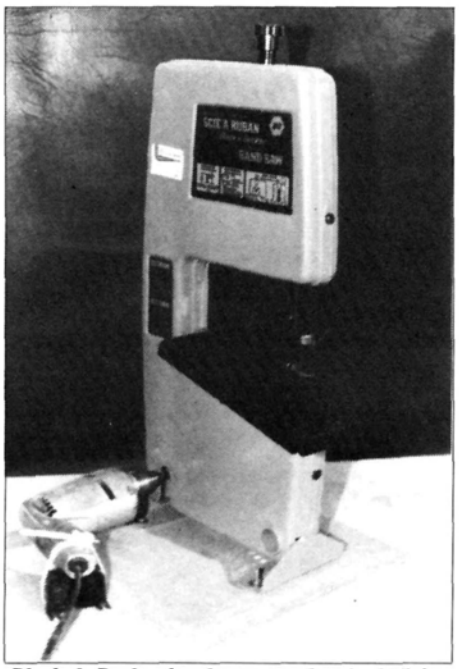


Kinner Model K Sportster by Dave Pape flies very well and has won several scale events.

Dave Pape of Edmonton, Canada, poses with his scratch-built Model K from DGA plans.

The model weighs in at 27 pounds, spans 117 inches, and has a 6-foot fuselage. Not content with the usual scale "decoration," Dave manufactured a set of pinking shears to the correct scale in order to cut his own pinking tape and produce authentic rib stitching and pinking. Small wonder the model has done well in scale contests!

It's nice to be able to congratulate a dedicated modeler on a model which has been well done and shows it in every aspect of its construction and detailing. Nice job, Dave Pape!



Black & Decker bandsaw uses electric drill for power and is ideal for model building.

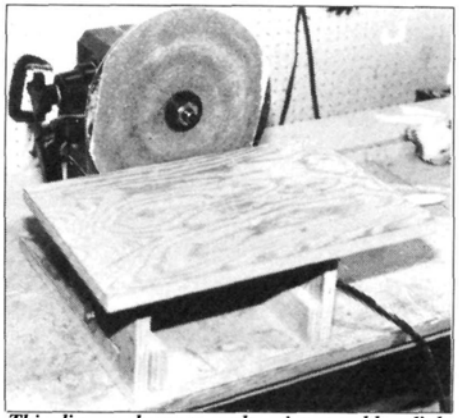
Let's Get Building

As we are in the depths of winter (and the building season for those who live in the snow belt), I'm going to spend some time on basic construction. Much of what I have to say will apply to building from plans, but it will apply to kit construction as well.

When starting a kit or a plans construction project, make sure the parts supplied or made up conform to the shapes shown on the plan. This usually isn't a problem with any quality kit, but it doesn't hurt to check them anyway. Any parts which do not fit the plans will create problems later on, so check and alter them now.

The basic tools for plans building are important. A means of accurately cutting curves is mandatory. You can do this with a coping saw, cutting by hand, or with a bandsaw, the preferred method. Black & Decker makes a small bandsaw which is ideal for this work. The saw is powered with an electric drill and is quite inexpensive (under $100). A variety of blades are available to suit any task. This saw is often available at special prices from your local hardware, department, or discount store.

A disk sander and a drum sander are valuable tools for parts making. The ones I use were made up from items I was able to pick up at bargain prices. They aren't up to professional standards, and they don't have all the fancy extras, but they do permit me to make the items I need. These three tools, bandsaw, disk sander,



This disc sander was made using an old radial arm saw motor and is extremely useful in making parts.

(Continued on page 54)

DUKE'S MIXTURE

Since the last Duke's Mixture column some 15 years ago, my hair has gotten thinner, my depth perception poorer, and I had to give up the Baron because I couldn't pass the flight physical anymore (Diabetes).

A couple of weeks ago I wanted to do a bit of flying with my new 40 Deluxe. I pulled a model out that hadn't been flown for 4 or 5 years, but looked in good shape, got everything installed and went out to fly. Once in the air, the airplane seemed to have a mind of its own. Following a fast pass, it would start a nice, pretty loop, and then all of a sudden tighten up real tight. Then, again, at times it seemed to want to gallop. Well, home I went, and out came the radio and in went another one. It just had to be a bad frequency. Back to the field a couple of days later, and, darn, the same thing again. Luckily, each time I got it down with maybe just a little bent gear. I was puzzling with a friend what could be causing the problem, when he walked over, pulled on my elevator, and low and behold, it was split in such a way that one half could be lifted up but not down. This is proof that wisdom doesn't come with age.

Most of our plant activity right now is centered around fine tuning our 1987 model Combat Special. The major differences from the Mark IV are larger crankshaft, brass liner, composite aluminum piston, longer rod, larger wrist pin, and a new method of holding the wrist pin. The new motor runs about 2200 RPM faster than our best Mark IV. This is impressive enough that I am considering making a 40 size version for the Quickie 500 type racers. Give me your thoughts on this please.

A few weeks ago a customer showed up at the field with a Telemaster 40 with one of our Eagle III's in it, and he wanted help. Well, my first thought was that he should really not use that engine because it had at least 4 times as much power as that airplane needed for a beginner. However, he was anxious, so I moved the throttle nyrod to the intermost servo position so that full transmitter travel ran the throttle from zero to about half open. And that's the way we checked it out. The way the Eagle III started and idled and worked at low speed through medium speed made my heart proud. Perfect linear operation, no cooling off, no sagging or hesitation when it was given the throttle.

Happy flying to you all.

Duke Fox

HELICOPTERS

(Continued from page 38)

collective-pitch machine, and will not take a lot of time to maintain. The Baron .28 has taught a lot of people how to fly, including yours truly.

Last on the list is the new Hirobo Shuttle, which seems to be catching on. The Shuttle is one of a new breed of Japanese models, with the added twist that it comes already built and is imported by Gorham Model Products. The Shuttle features Bell-Hiller mixing, and autorotation as standard equipment. It uses a toothed belt for the tail rotor drive and is mostly constructed from glass-filled nylon components. If you're going the route of the Shuttle, try to learn as much about mechanics as you can so that you'll have a better understanding of how the helicopter functions.

Since the kit is pre-built, the Shuttle will get you flying fast, as all you'll need for completion is to install your radio and engine. Some of the hobby dealers who specialize in helicopters are even offering the Shuttle as a package with everything ready to go—though there are the purists who feel that you miss out on part of the fun by buying a helicopter pre-built, and that you may have difficulty repairing the model after a crash because you won't be familiar with the mechanics or the procedures of assembly. At any rate, the Shuttle does perform well, and is capable of aerobatic flight when you're ready for it.

In summary, some of the things that make these kits right for the first-time pilot are that they fly in a manner that is predictable, they're easy to repair because they feature simple mechanics, and they are affordable.

Whenever you hear the terms "predictable" and "stable," most of the reference is to the handling of the machine. A stable helicopter will practically fly hands-off as if being guided about its course much like a well-trained horse. It usually takes quite a bit of effort and expertise to achieve this feeling, and will always be the result of uncompromised attention to minor detail. Having the help of a true expert may seem like a luxury, but will really speed the process.

There are a lot of great helicopters out there these days, and I think they get better all the time. One of the interesting things about the model helicopter industry is that no kit ever really is obsolete, meaning that if the kit will fly, it will still serve a purpose. So the point is that although you should look for certain qualities in your choice for the right helicopter to get you started, it would be really hard for you to make a major blunder no matter what you wind up with.

A tip on balancing rotor blades was given to one of my friends by Robert Gorham (of Gorham Model Products) the other day, and I thought I might pass it on. When balancing the blades spanwise, Robert finds the exact point of balance by setting the blades on the razor's edge at 45° angles to the chord of the blade from two directions. This will give you a very accurate picture of where

(Continued on page 54)

Road & Bench Review

by STEVE POND

Kyosho ROCKY 4WD

Deliver the ace with this off-road scrapper!

FOR THE MOST part, people looking to enter the world of off-road R/C car racing are limited to the docile, less competitive cars because of their ease of construction. Some modelers may try to steer clear of this by purchasing a pre-assembled car, but these cars are also designed around the beginner and don't pose much of a threat to the more sophisticated dirt burners. Great Planes Model Distributors* has just introduced the Kyosho Rocky 4WD, which is going to give a whole new meaning to the word "beginner." Although it might be an injustice to call the Rocky a beginner, the ease of construction allows just about anyone to build this screamer without any confusion.

THE KIT. The Rocky's long list of features begins with its double wishbone front and rear suspension. This car also has threaded upper links on each corner to allow for camber adjustments. To smooth out the bumps, it has two oil-filled coil-over shocks in the rear and a horizontal mono-shock in the front. As for the drive-train category, the Rocky starts off with a dynamite LeMans 240 ST high-performance motor. The motor is linked to the wheels via a 9.59:1 gear reduction. To get the power to the front wheels, the Rocky uses a low-friction chain drive like its other four-wheel drive brethren. The power is then transmitted to the ground with the low-profile block-pattern tires which saddle the lightweight wheels. To round out the package, Kyosho gave the Rocky a smooth belly pan to glide over any obstacle it might encounter.

Everything you need to complete the car, including grease, a special allen wrench, and oil for the shocks, is included in the kit. You'll only have to supply some common tools, such as screwdrivers, pliers, and a sharp hobby knife. Other items you must supply are a 7.2-volt battery pack, a battery charger, and a two-channel radio-control unit. The guidance system I chose is the Magnum Jr. from Futaba*. This is an economical, but state-of-the-art, wheel-operated two-channel radio that I'd recommend to anyone. Futaba is a lord among serfs when it comes to radio-control units. This particular package comes with FP-S28 servos, an FP-R2GS receiver, and an On/Off switch with a battery harness. When combined with the Rocky, it should prove to be a force to reckon with on the track.

As far as the battery and charger are concerned, these are both available from Kyosho. The charger I chose was the Kyosho Auto-Charger. Its amperage is adjustable to

photos by LOUIS V. DeFRANCESCO

suit almost any battery pack. The Auto-Charger also has an auto shut-off that shuts down the charger when the battery has a full charge.

ASSEMBLY. The actual assembly of the Rocky was uneventful with the exception of an unexpected twist. Great Planes was in such a rush to bring you this latest dirt burner that they didn't have time to convert my instruction manual to English. Although I don't know a word of Japanese, the assembly went smoothly. Rest assured that your manual will be in English.

The construction begins with the assembly

(Continued on page 90)

HELICOPTERS

(Continued from page 50)

to add span-wise weight so that the blades will match more closely on both the span-wise and chord-wise axes. This adds a little extra time to the process, but shows up later when you're trying to get rid of that last bit of vibration. I'll cover the entire blade-balancing process in a future article.

Next month I'll begin to cover the first steps of putting the machine together, and try to touch on some time-saving techniques that can be used in the workshop. Until then, try to keep the spinning side up!

Craig Hath, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the companies mentioned in this article:*

Circus Hobbies Inc., 3132 S. Highland Dr., Las Vegas, NV 89109.

Gorham Model Products, 23961 Craftsman Rd., Calabasas, CA 91302.

Hobby Shack, 18480 Bandilier Circle, Fountain Valley, CA 92728-8610. ■

GIANT STEPS

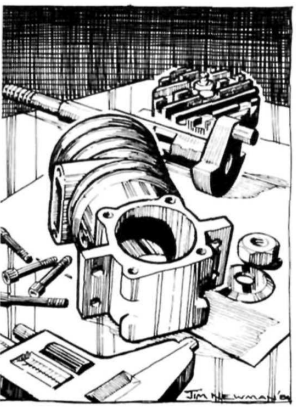
(Continued from page 49)

and drum sander, make building from plans a delight. They permit accurate parts to be made, parts which conform *exactly* to the plans.

Before cutting any wood, transfer the patterns from the plan to the building material. As I prefer not to cut my plans for patterns, I usually trace the pattern onto some transparent material. There are some commercial products which do this very well and there are many others which will do the job.

As most former and wing rib patterns are curved, and they are usually not standard curves, I use an assortment of French curves for laying out accurate patterns. There are a number of drafting items which will help in laying out irregular curves as well and these items are

(Continued on page 78)



About Those Engin

by JOE WAGNER

THE POPULARITY of various kinds of model airplane engines changes from time to time. These days four-cycle motors are big news—and big sellers. Some modelers even think that the four-cyclers will make our faithful two-cycle engines obsolete. Don't worry. That will never happen!

First, the two-cycle motor is the simplest possible type of internal combustion engine. You can make one with only twelve components: prop driver, washer, and nut; crankshaft, connecting rod, and piston; cylinder, crankcase, and case cover; glow head, needle valve, and needle valve body. That's fewer parts than just the valve train alone of a typical four-cycle motor.

Each engine part costs money to make and takes time to assemble. Thus two-cycle motors are less expensive. And with fewer parts they have less to go wrong—and less to get bent in crashes.

Second, two-cycle engines, having few adjustable elements, are easy to keep running right, day in and day out. Once you learn the difference in sound between running "rich" and "lean," you've just about got it all. Sure, two-cycle motors do have their problems. You've got to feed them the right kind of fuel, use the proper plug, watch out for leaky gaskets, and so on. But the four-cyclers have all these same difficulties, plus plenty more of their own.

Third, four-cycle engines need a complex mechanism to open and close their valves at the proper times, with gears, cams, pushrods, rocker arms, or whatever. There's a limit to how small this can be made. Consequently, you won't be seeing any commercially-produced four-cycle engines in .049 displacement.

What all this adds up to is that, regardless of today's enthusiasm for four-cyclers, we two-cycle engine lovers needn't worry about our favorite variety of model airplane motor becoming extinct.

Speaking again of .049s, they're a good example of change in popularity. When they first came out, ½A motors quickly became the biggest thing that ever hit the hobby industry. They were highly favored for almost twenty years, powering free flight, U-Control, and R/C models by the millions. From 1953 until just a few years ago, the main product lines of Ace R/C* (the most comprehensive source of do-it-yourself R/C gear anywhere) were small, lightweight R/C equipment and model kits for ½A radio control. Yet now the trend is toward the big engines, and you seldom see an R/C model with anything smaller than a .40 in it.

That seems odd to me. Big engines need large, complex models, and extensive area to fly in. An .049-size model, on the other hand, is easy to build and can be flown from a football field. As for costs, a propeller alone for a Quadra costs more than a Cox "Black Widow," and you can fly ½A all day long on a pint of glow fuel.

The ½A glow engine is an all-American development that deserves more respect than it usually gets. Let's take a backward look and see where it came from.

The first commercially-produced ½A engine was the K&B "Infant" of early 1949. With an .020 displacement and a 4-inch stamped-from-sheet-aluminum propeller, it put out roughly the same amount of thrust as four strands of ¼-inch rubber. Lots of modelers bought them, mostly because of their novelty and incredibly small size for the time. But they didn't become popular for powering models. Infants were finicky to adjust; besides, glow fuels in 1949 were unsuitable for tiny motors. Thus most Infants got put aside—especially after the OK "Cub" came out that summer.

The Cub was the first of the .049s, and was an immediate success as a model powerplant. Its manufacturer, the Herkimer Tool and Model Works, hadn't been doing well with their line of .29-

OLD-TIME ENGINE REPLICA MANUFACTURERS

Atom .097: Morrill-ADC, P.O. Box 1210, Simi Valley, CA 93062.
Bantam .16: Spielmaker Engines, 4690 Burlingame S.W., Wyoming, MI 49509.
Bantam .19: Model Aviation Historical Society, 12 Cook St., Rowayton, CT 06853.
Brat .14: Karl Carlson, 14600 Ramstad Dr., San Jose, CA 95127.
Brown Jr. .60: Herb Wahl, P.O. Box 61, Forksville, PA 18616.
Deezil .125: Gordon Burford, 86 Tierney Dr., Currombin, Queensland, Australia 4223.
Edco "Sky Devil" .61: Terry Toups, 6620 Wonderlin Ave., San Diego, CA 92114.
Forster .29, .35, & .99: M&G Engines, P.O. Box 6026, Denver, CO 80206.
Hurleman .49 & .98 Twin: Herb Wahl, P.O. Box 61, Forksville, PA 18616.
K & B "Torpedo" .29 & .32: J&J Aircraft Accessories, 904 W. 233rd, Torrance, CA 90502.
Lindberg "Hornet" .19: John Morrill, 143 Richmond St., El Segundo, CA 90245.
Lykens Brown .12: Bill Brown, P.O. Box 61, Forksville, PA 18616.
McCoy .29: Ed Solinburger, 1551 Lynn Court, Santa Rosa, CA 95405.
Megow .19: Spielmaker Engines, 4690 Burlingame S.W., Wyoming, MI 49509.
Morton M-5 .92: Model Aviation Hist. Soc., 12 Cook St., Rowayton, CT 06853.
Ohlsson "Gold Seal" .56: Herb Wahl, P.O. Box 61, Forksville, PA 18616.
Orwick .23, .29, & .64: Klause & McCollum, P.O. Box 2699, Laguna Hills, CA 92653.
Orwick .64: Bill Daniel, 8165 Castenada Road, Atascadero, CA 93422.
Orwick .29, .32, .64, & .73: Bert Striegler, 5831 McKnight, Houston, TX 77035.
Spitfire .61: M&G Engines, P.O. Box 6026, Denver, CO 80206.
Super Cyclone .61: Tom Morrison, 1628 West Seldon Lane, Phoenix, AZ 85021.
Note: All these engines are in very limited production. Prices are generally high and availability is low. A long waiting period is usual for most of these engines except Streigler's Orwick .64s and Morrison's "Super Cyclones."

SOURCES OF ENGINE PARTS AND IGNITION ACCESSORIES

Kustom Kraftsmanship, P.O. Box 2699, Laguna Hills, CA 92654; 714-830-5162.
Micro Model Engineering, 1301 W. Lafayette, Sturgis, MI 49091.
Chris Rossbach, R.D. #1, Queensboro Manor, Gloversville, NY 12078.
Roger Schroeder, 4111 West 98th St., Overland Park, KS 66207; 913-648-4265.
Dick McCoy, 5674 San Bernardino Street, Montclair, CA 91763.
Fred T. Collins, 29 Stewart Ave., Pittsburgh, PA 15227; 412-881-8553.
Walter Craig, 204 Penrith Crossing, Grafton, VA 23692; 804-898-4991.
Note: Micro Model Eng. carries the widest selection of engine parts. A catalog costs $2 postpaid. Fred Collins carries mostly fuel tanks. Roger Schroeder has casting kits for machine-it-yourself replicas of old engines. Dick McCoy has some authentic parts for McCoy (Duromatic-manufactured) engines. Walter Craig specializes in restoring beat-up old engines. Kustom Kraftsmanship has spark ignition components and some parts....

and-up engines, but sky-rocketing sales of the Cubs revitalized the company. The original .049 displacement Cub was quickly followed by larger versions: first an .074, then an .099, and (in 1952) a .147. These engines all had the same basic design, merely being scaled up from the .049 version.

Third of the original ½A motors was Mel Anderson's "Baby Spitfire" .045, which came out in the fall of '49. Beautifully made, it was just a bit too delicate. Its needle was exceptionally easy to bend or snap off. But it was such a fine performer that hundreds of thousands were sold. A little-known fact about the Baby Spitfire is that its bore, stroke, and rod length were exactly half the corresponding dimensions of the "Baby Cyclone" of 1936—the first engine that Mel had been involved in manufacturing.

All the first generation of ½A engines were of the "long-stroke" type, with the piston diameter less than its stroke. This worked all right, especially with the low-nitro fuel then in use. But in 1953 Bill Atwood and Bob Holland decided to take the "short stroke" route. They produced the revolutionary "Wasp" .049.

The Wasp was a marvel of a motor. Powerful, easy to start, and so compact that cowling it in was no problem at all, it became my favorite ½A engine while I was at Veco. I designed several kits around it. It was one of the few motors that was equally suitable for a beginner and a red-hot competitor. As far as I could tell, in 1953, the Wasp was the unbeatable .049. Then along came the Cox engines!

The first of the Cox reed-valve engines never became widely used. It was just too different. Designed for U-Control use, it had a built-on fuel tank about the size of the bowl of a corncob pipe. But it didn't take Roy Cox long to see the error in this, and in a few months the 1952 "Space Bug" was supplanted by the "Thermal Hopper" without a fuel tank, and the "Space Bug Jr." with a small nylon tank the same size as has been used ever since on the "Babe Bee" motors.

The performance of the first Cox ½As made them impossible to ignore, even though their mounting was not easy. You couldn't just unscrew your Wasp from the firewall of your airplane and put a Thermal Hopper in its place. It took a whole new installation. My first ½A R/C model had a Thermal Hopper in it, and the engine mounting took as long to design as the rest of the fuselage. But it was well worth it!

Cox engines came into their own with the 1956-58 line: "Babe Bee," "RR-1" (with rear rotary induction instead of a reed valve); the "Pee Wee" .020, and the "Golden Bee" .049. These top-quality motors and their successors drove all other ½A engines off the market.

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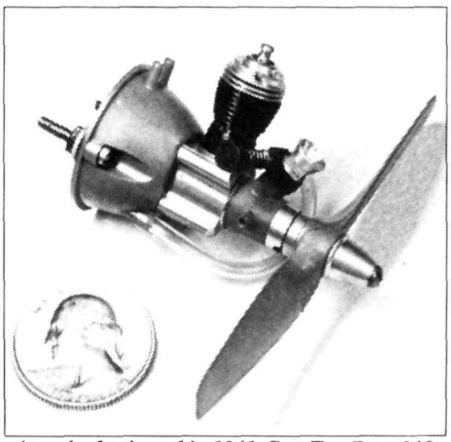
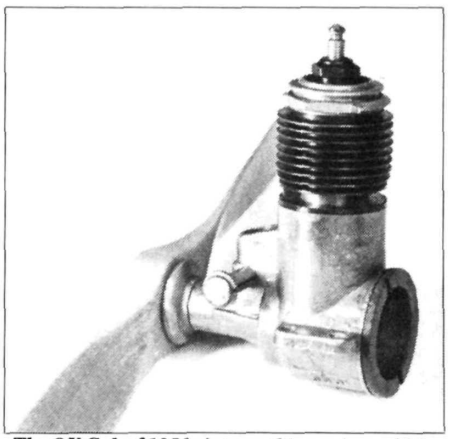
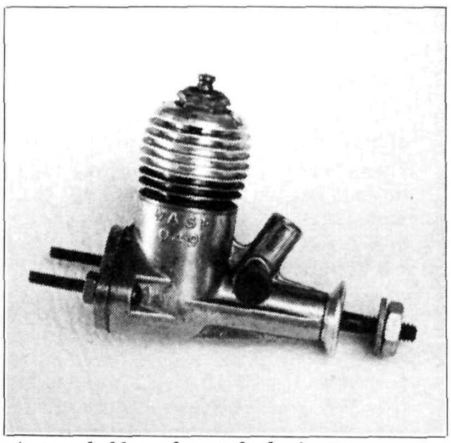


Amazingly tiny, this 1961 Cox Tee Dee .010 could turn more than 30,000 rpm.



The OK Cub of 1950 vintage, this one is an .099.



A remarkable performer for beginner or expert was the 1953 Holland Wasp .049, first of the short-stroke ½A engines.

FROM THE COCKPIT

The Mustang *Family*

MUSTANG: If there is any airplane that can be identified by every modeler and pilot in the free world, it has to be the P-51 Mustang. Right? Wrong!

The most famous piston-driven fighter of all time.

Forming up over Hamilton, Ontario, during the Canadian Warplane Heritage Air Show, are Pete McManus, Hess Bomberger, Don Davidson, and Bill Clark in their P-51Ds. Photo was shot in June 1986 by Budd Davisson.

BEFORE THERE WERE MUSTANGS—THERE WAS THE APACHE

A FEW YEARS ago at the National Business Aircraft Association Convention—a prestigious gathering of professional pilots—one of the major exhibitors searched out the sole remaining flyable P-51B and towed it through the streets of Anaheim to display in its booth at the Convention Center. As one might expect, the airplane was the hit of the show since it was so out of context. Standing around the airplane was interesting because here was a gathering of professional aviation types who were continually misidentifying the airplane.

"Of course it's a P-40...look at that fuselage and the canopy, it can't be a Mustang."

"Boy that's a really nice Spitfire you have there, fella."

This little episode showed that if you change a few major lines in a popular face, it becomes unrecognizable.

There are Mustangs and then there are Mustangs. In fact, before there were Mustangs, there was the Apache. The what? That's right. Originally the P-51 was designated the Apache and it was at the urgings of the British that its name was changed to Mustang. Of course this was early on in its career, one that lasted as long as any combat airplane known. It first flew in 1941 as the XP-51 and was in service as a front-line fighter in the Dominican Republic until only two years ago.

We're not going to recount the history of the P-51 here since there are probably more books, magazine articles, and movies depicting that airplane's development than any other single machine in the world. However, it might be useful to home-in on the four main variants of the Mustang and briefly summarize what it is that makes each distinct. This is especially important to the modeler, since it's the details that separate an accurate model from one that is a caricature.

P-51A (A-36). Although there were many minor modifications from the X P-51 to the production P-51As, essentially the airplane remained the same. The razor-back fuselage design was very much in vogue in those days because it was thought to be necessary for perfect streamlining and speed. The bird-cage canopy was made as small as was practical, and allowed the pilot to see while landing and kept him from getting his buns shot off. The canopy opened on the left side with the side panel swinging down and the top panel swinging up, joining in the corner with a stout locking mechanism. A few of the P-51As which saw service as Mark I and II Apaches in the RAF were fitted with their famous "Malcolm" hood. This gave a rather bulbous appearance to the cockpit area but gave the pilot much better all-around visibility and he could raise his seat higher for landing.

The characteristic nose of the P-51A was dictated by the use of the Allison V-12 liquid-cooled engine. Only this model used that engine and its down-draft carburetor needed the airscoop on top the cowling, which gave the nose a more centered appearance than later models. The A models were also the only Mustangs to be equipped with nose-mounted machine guns located under each cylinder bank.

In addition to the two nose guns, two additional machine guns were located in each outer wing panel with barrels actually flushed back inside the wing with blast tubes surrounding them. This was in direct contradiction to later technology in which the guns projected out of the wing.

(Continued on page 64)

article and photo by BUDD DAVISSON


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photo by BUDD DAVISSON

A subtle difference which is often missed in models is that the belly scoop on the A model is nowhere near as deep or voluptuous as that on the later Merlin-powered airplanes. This smaller scoop combined with the sleek fuselage lines give the airplane an overall dainty look as compared to later D models.

The dive-bombing version of the 51A, the A-36, was for all intents and purposes the identical airplane visually, except on top and bottom of the wings about midway out there was a slot approximately ¾ inch wide and 3 feet long. Out of this slot popped dive brakes which looked for all the world like cast aluminum gratings that would be used to secure a basement window against burglars.

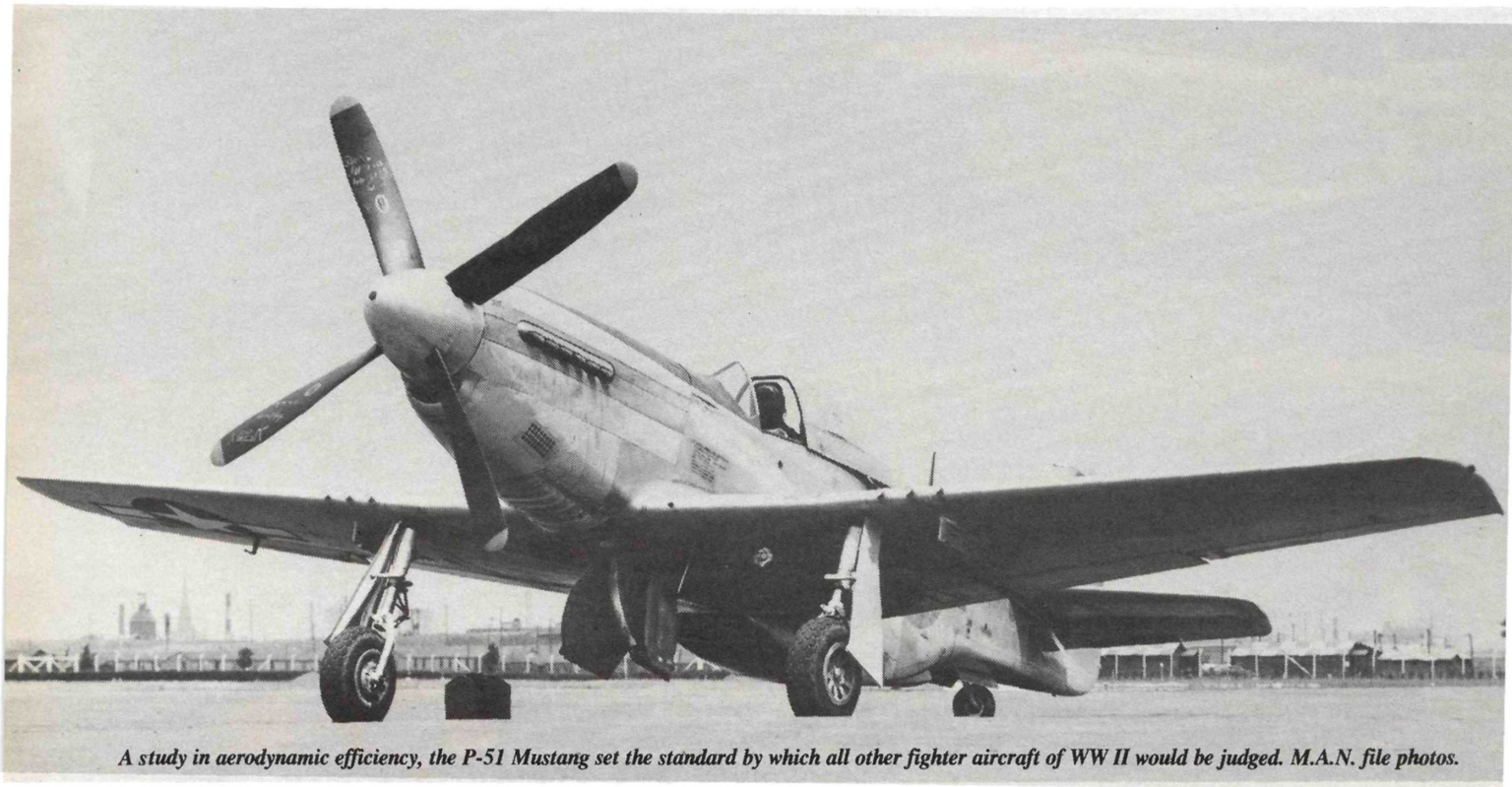
The Allison-powered A models were delightful airplanes according to their pilots. However, the engine was just not designed for high-altitude output since its single-stage supercharger ran out of poop long before the airplane reached 20,000 feet. At low altitude, though, it was a fine airplane. In fact, it was such a fine airplane that it was the British who initially talked the Army Air Corp into investigating the installation of their two-stage super-charged Merlin engine in the airplane. To test the concept, North American sent several engineers to England, where prototype installations of the engine were made. What was a fine airplane at low altitude was found to be absolutely superb when given enough engine to get it up into the 25,000- to 35,000-foot levels.

P-51B/C. There is an erroneous assumption among many Mustang buffs that the B and C were simply A models with the Merlin engine screwed on the front. This is definitely not the case. Although the Bs and Cs saw various structural modifications carried on throughout their production life, the installation of the Packard-built Merlin engines dictated many subtle structural changes which aren't obvious from the outside, including new fuselage longerons, a new firewall configuration, etc.

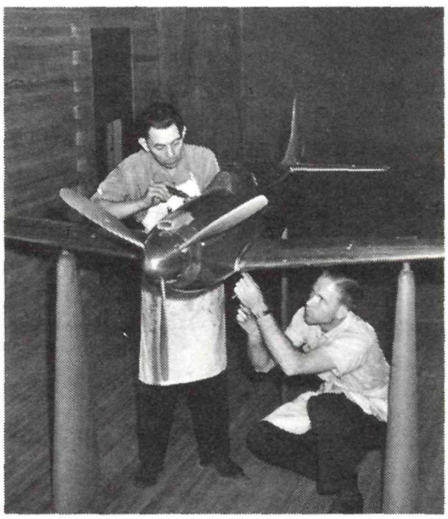
The most obvious change to the airplane naturally occurs firewall-forward, where entirely new sheet metal was designed to fit around the Merlin. Obviously the entire upper cowl was changed and the air inlet of the A model eliminated, as were the two side guns.

One small detail that many modelers miss when doing Mustangs is a tiny little strip of aluminum which juts upward between the spinner and the top of the cowling. In direct contradiction to good aerodynamic flow, this strip of aluminum juts up about ⅜ inch outside the spinner's diameter and is curled forward rather than backward. This is an oil deflector meant to catch any oil or grease coming out of the propeller and deflects it off to the side so it doesn't cover up the windshield. Few civilian Mustangs still possess this little deflector since it must cost dearly in speed—and it's ugly.

Obviously for the more powerful engine to work at a higher altitude more



A study in aerodynamic efficiency, the P-51 Mustang set the standard by which all other fighter aircraft of WW II would be judged. M.A.N. file photos.



During the development stage, models of the P-51 were built for wind-tunnel analysis of aerodynamic streamlining. The above model is ¼-scale.

Designed and built to British specifications, this Mustang bears RAF insignia.

traction was needed and was provided in the form of a four-bladed—as opposed to a three-bladed—propeller. Almost all B and C models were delivered with hollow steel propellers with "cuffs" around their shanks. These cuffs are flexible rubber boots meant to streamline the rounded shank of the blades. Some later models, specifically late Ds and Hs, used a paddle-blade propeller without the cuff, designed for high-altitude work. This is the propeller most often seen on civilian Mustangs.

Many things were subtly reshaped on the B and C Mustangs, the most noticeable of which is the belly scoop. The Merlin's two-stage supercharger raised inlet air temperatures so high that an inner cooler was used to reduce inlet air temperatures. This in turn required additional radiator area over and above that normally required to cool the engine. So the scoop actually carried three radiators—the normal coolant radiator, the inner cooler, and the oil radiator. That is why the scoop and dog house (the dog house is the fuselage fairing which contains the radiators) are much deeper and more pronounced. This also meant reshaping the air outlet door at the bottom rear of the scoop which was controlled in flight by temperature-activated servos. As the coolant temperatures increased, the servos automatically opened the door and let more air out.

Even though the P-51Bs and Cs carried different designations, they were in reality supposedly identical airplanes. I say supposedly because they were produced in different plants (Englewood, California, and Fort Worth/Dallas, Texas) and minor changes did creep in, but not enough to change the airplanes visually.

P-51D. What can we say about the D model P-51 that hasn't already been said? This is the Mustang *everybody* visualizes when the name comes up.

The bubble canopy was the obvious result of lessons learned in combat—you had to see the other guy if you didn't want to become a statistic and that meant opening up the vision of the pilot as much as humanly possible. The Brits did this with Malcolm-type hoods on their Spitfires and Mustangs, but even they went to bubble canopies in later model Spitfires.

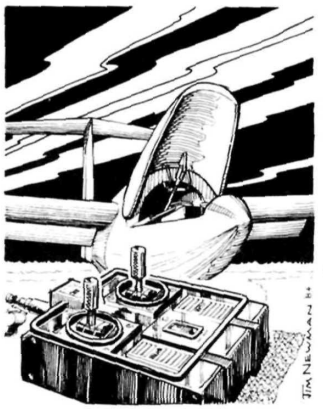
The D model is much more than simply a recanopied earlier model airplane. With the D model, North American engineers took the opportunity to refine and modify the machine in many structural areas, most of which are indistinguishable from the outside. There is, however, one D model difference that should be noted. The first production D models and most of the Australian airplanes don't have the characteristic dorsal fin in front of the rudder. This was added after the first few production batches were found to have directional stability problems because of the greatly reduced keel area associated with the bubble canopy.

Designated as the A-36, this version was the world's fastest dive bomber.

P-51H. Naturally the Air Corp knew they had a winner in the Mustang; but even winners can be improved upon and so the engineers of North American never ceased fiddling with their design in an effort to squeeze the last mile per hour and last foot of range out of it. Eventually, after going through a large number of prototypes and short production runs, they decided to totally redesign the airplane, reducing its weight as much as possible. They wanted to build the ultimate Mustang and it was designated P-51H.

The P-51H is such a totally redesigned airplane that very few of its parts are

(Continued on page 90)



Soaring News

by JIM GRAY

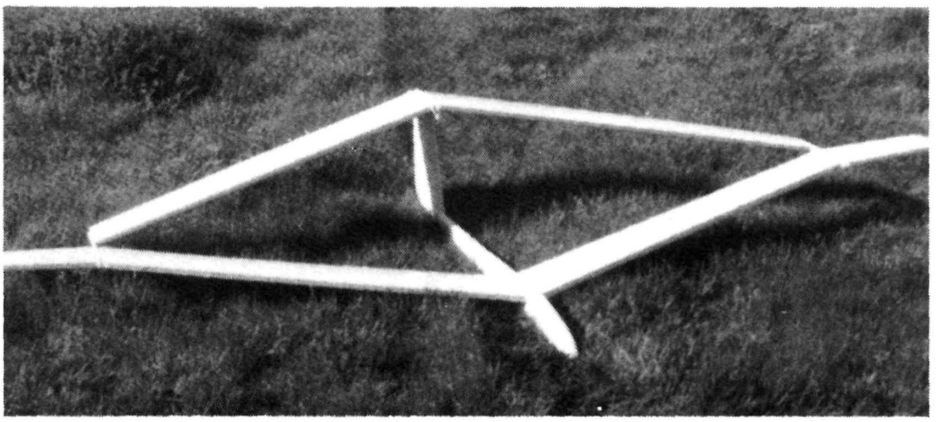
THIS MONTH I have some things for you that ought to make the 1987 soaring season start off with a bang. First, how about some "soarces" (sources) for a few of those goodies you've been looking for? Right; you've spent your Christmas money on the family, and now it's time to spend just a little on yourself...so here goes.

Have you ever wondered how a sailplane would perform if you stretched the wing, increased the chord, changed the weight, or used a different airfoil? Sure you have. We all have...but now there's something that will tell you a little about the model without you having to build the sailplane to find out. That something is called the Sailplane Design Program, and it's available from Eddie Dumas, Jr.* Eddie is 17 years old, has been flying sailplanes for five and a half years, and has been a computer hobbyist for the past six years, so he combined his two major interests and came up with a neat program for the Commodore 64 and 128 personal computers to aid in R/C sailplane design.

The program uses several routines obtained from different places to analyze sailplane performance. The basic equations for velocity, induced drag coefficient (wing), Reynolds Numbers, L/D, and sink rate are taken from Eric Lister's *Sailplane Designer's Handbook**. Routines for computation of the profile drag coefficient of the wing, stab, rudder and fuselage are taken from Martin Simon's article in *Soartech I**, which covered the use of a hand calculator for performance prediction. Please note that either actual or theoretical data can be used for the calculation of profile drag coefficient.

Sequential data files are used to store both airfoil polar data and sailplane design data. The following files are included on the development diskette:

Airfoils: Eppler 193, Clark Y, Wortmann FX60-126, Eppler 205*, Eppler 214*. The asterisk-marked 'foils use data from Bill Forrey's column in *Model Builder* magazine, while the others use data from the German book *Profil Polaren fuer den Modellflug* by Dieter Althaus.

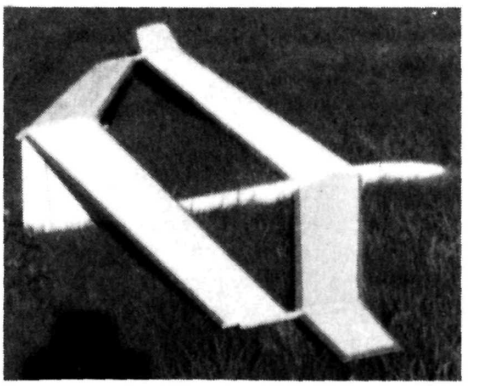


The joined-wing design is an experimental subject which has been seen as a result of Dr. Wolkovitch's paper. See text. Photos by Dave Jones.

Sailplane Designs: Aquila, Camano 100, Drifter II, Frisky II, Olympic II, Paragon, Sagitta 600, Sagitta 900, Sailaire, and Windsong.

The program is arranged so that you can add your own data to that which is already there, and thereby increase the value of the program by customizing it to your own needs. The price for the basic package is $20 and will include the five airfoil files and the ten sailplane data files. Owners of programs will be notified of any changes and updates as they become available, and these will be supplied free of charge to purchasers of the diskette. A replacement disk is also available for $5 to anyone whose original disk becomes unusable, if the original is returned.

Aerospace Composite Products* has moved to a new location in California, but will continue to supply Kevlar, Carbon Fiber and glass cloth in various plies, weaves, and thicknesses, as before. I've used some of these materials with good results, and suggest that anyone who would like a source of composites write to George Sparr at the address listed at the end of the column. Prices are a bit high, but competitive, and the service you get is superb.



Flight characteristics appear to be similar to those of conventional sailplanes.

Viking Models USA* is a very fine source of scale fuselages, foam wings (cut to spec in some cases and pre-covered with obechi veneer), miscellaneous bellcranks and canopies, and many other hard-to-find items, as well as plans for a very large number of sailplanes. Jerry Slates is the proprietor, and an excellent person to deal with. Many readers have written to tell me how pleasant and easy it is to deal with Jerry, and how helpful he is in finding those needed materials, such as arrow shafts, double-sticky tape, etc. Incidentally, Jerry's fiberglass layups are second to none in quality...at a very reasonable price.

The *1985 Sailplane Symposium Proceedings* is now available from Walt Seaborg*. Walt also has the 1983 and

1984 proceedings as well. They are $10 (for 1985), $8 (for 1984), and $7 (for 1983) at the book rate. If you wish, you can send another dollar and get them by First Class mail. The *Proceedings* cover the transcribed talks and discussions over a two-day period (complete with photos and drawings where appropriate) hosted each year by the MARCS group in Madison, Wisconsin. The 1985 version comes to 199 printed pages, plus the two covers, and contains a great deal of material not available elsewhere. For example, the insights provided by Roland Stull's talks on the meteorology of soaring is of direct value to the sport flier as well as the competition pilot, and can't be found readily in other publications. You really ought to have the *Proceedings* for your personal soaring library, as it is a valuable reference work for the dedicated soaring pilot and sailplane builder.

Joined-Wing Design

Most of you will recognize the name of Dave Jones*, a frequent contributor to "Soaring News," and a designer of some extremely interesting flying-wing sailplanes. This month, Dave presents a couple of photos and comments relating to the joined-wing concept. Dave says:

"...I have seen this plane fly at our field, and it flies pretty much like any other conventional sailplane. As you can see from Dr. Wolkovitch's paper (enclosed with Dave's letter to me), much experimental work has been done on various versions of this type of configuration. The model, I believe, belongs to Dr. Wolkovitch. It was flown in a thermal contest at our field with modest results, including thermalling. As you might expect after reading the paper, the configuration is not especially adaptable to sailplaning although it flies well. It might make a good slope racer in its low aspect ratio form. The other pictures are of our field during the early part of the year when it is covered with grass. I think it is the best field in Los Angeles County. Thermals abound and long flights are common... many in the 30-40-minute range, mostly with various ones of my flying wings.

"The club (SULA—Soaring Union of Los Angeles) has several contests each month: the club monthly (open to *any* AMA member), Novice (for teaching beginning fliers), SULA Bird (one-design), and flying wing (open to all tailless models) gives us a full month. Four two-meter contests are thrown in each year. Also, each soaring club of Southern California Soaring Clubs (SCSC) hosts a contest each year. Other events at our field include F3b, electric, and hand-launch contest."

Gosh, Dave, what do you fellows do in your *spare* time? Whew! What a schedule. Makes you want to go to California just to fly, doesn't it? Thanks for writing, and for sharing. Incidentally, I have read the Wolkovitch paper with great interest, and think that there is a possibility that the joined-wing concept could be successfully applied to sailplanes...but that a successful application will neither be easy nor quick to achieve, as much experimentation is yet to be done.

MAIDEN FLIGHT PREFLIGHT

Internal (Remove wing if attached)

1. Servo Mount, Servos, Servo Arms Secure.
2. Pushrods Secure.
3. Receiver And Battery Padded And Secure.
4. Check For Loose Items/Wires That Could Foul Servo Or Pushrod Movement.
5. Check For Fuel Leaks—Tank Area Fuelproofed?

Wing

1. Check For Breaks, Warps, Etc.
2. Insure Center Section Is Adequately Reinforced.
3. Check Aileron Pushrods And Aileron Clevises (If Equipped) Before Securing Wing To Aircraft.
4. Brief New Pilots On Adequacy Of Rubber Bands.
5. After Wing Is In Place, Check For Proper Incidence And Alignment As Best You Can.

Engine Area

1. Fire Wall Area Fuelproofed.
2. Check Engine Mount, Engine, Muffler And Prop Nut And/Or Spinner For Security.
3. Check Prop For Nicks, Cracks, Etc.
   Brief New Pilots On Importance Of This Check.
4. Check Nose Steering Mechanism (If Equipped).
5. Check Cowl Secure (If Equipped).
6. Check Engine For Obvious Thrust Misalignment.

Tail Section

1. Check Vertical Fin, Rudder And Rudder Clevis For Security.
2. Check Tail Wheel Security (If Equipped).
3. Check Horizontal Stabilizer, Elevator And Elevator Clevis For Security.

Balance

1. Balance Aircraft With Fuel Tank Empty.
2. Show New Pilots Proper Balance Point And Balance Technique.
3. Explain Danger Of A Tail-Heavy Aircraft.
4. Tail-Heavy Situations Should Be Corrected Prior To Flight.

Range Check/Starting Engine

1. Insure That Radios Have Been Adequately Charged.
2. When Frequency Pin Is Available, Attach To Antenna And Range Check Aircraft With Antenna Collapsed (Explain Why To New Pilots).
3. Check Transmitter For Correct Rates.
4. Check To Insure That All Flight Controls And Engine Control Move In The Proper Direction.
5. Check Flight Control Surfaces To Be In Proper Trim.
6. Fuel Aircraft.
7. Start Engine—Explain How/Why.
8. Tune Engine (Away From Pits). Explain How/Why.

Note: Have A Clear Understanding With Beginners **Prior to Flight** How You Want To Handle The Transfer Of The Transmitter In Event Of Trouble.

Handy Checklist

Finally, I'd like to reprint here a two-sided checklist that was given to me several years ago. I can't remember where it came from, but I *can* recommend it highly. My version is encased in a durable, clear plastic, and reposes in my field box for use when needed. As you can see, there are two parts: Maiden Preflight, and Routine Preflight Inspections. There are paragraphs covering engine and starting engine procedures which will not often be used by most of us sailplaners,

but the remainder of the checks will be (or ought to become) routine for flying safety. I'd like to suggest that you photocopy the two sides and place them in your own plastic folder for constant and continuing use at your field. Clubs could make up some for the members. As a matter of fact, I believe that the original may have come from the AMA and, if so, copies could well be available from them. In any case, safe flying is no accident, as they say.

Keep your letters and comments coming, gang, and may your 1987 soaring year be bigger and better than ever!

Jim Gray, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the people and companies mentioned in this article:*

Eddie Dumas, Jr., Sailplane Design Program, 3220 Boomerang Lane, Knoxville, TN 37931; 615-690-3180.

Sailplane Designer's Handbook, *Eric Lister, 410 Regina Drive, Clarksburg, MD 20734.*

(Continued on page 78)

Always fly your aircraft in accordance with the AMA Safety Code as found in the latest edition of the Official Model Aircraft Regulations.

ROUTINE PREFLIGHT INSPECTION

Internal (Before Attaching Wing)

1. Check Servo Mount, Servos, Servo Arms Secure.
2. Check Pushrods Secure.
3. Check Receiver And Battery Secure.
4. Check For Loose Items/Wires That Could Foul Servo Arms/Pushrods.
5. Check For Fuel Leaks.

Wing

1. Check Wing For Breaks, Warps, Cracks, Etc.
2. Check Aileron Pushrods, Linkage And Clevises (If Equipped) Prior To Securing Wing To Aircraft.

Engine Area

1. Check Engine Mount, Engine, Muffler, Prop Nut And/Or Spinner For Security.
2. Check Prop For Nicks, Cracks, Etc.
3. Check Nose Steering Mechanism (If Equipped).
4. Check Cowl Secure (If Equipped).

Tail Section

1. Check Vertical Fin, Rudder And Rudder Clevis For Security.
2. Check Tail Wheel (If Equipped).
3. Check Horizontal Stabilizer, Elevator And Elevator Clevis For Security.

Range Check/Flight Control Check

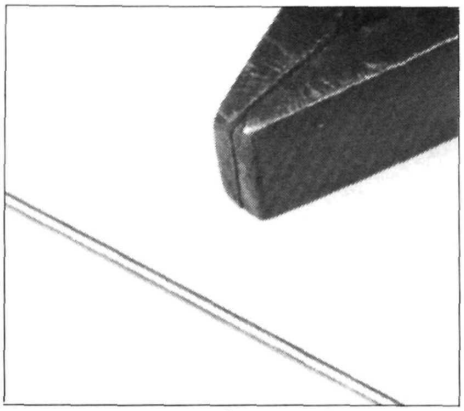
1. When Frequency Pin Is Available, Attach To Antenna And Range Check Aircraft With Antenna Collapsed.
2. Check That Flight Controls Move In Proper Direction.
3. Check Transmitter For Correct Rates.
4. Check Flight Control Surfaces To Be In Proper Trim.

How To:

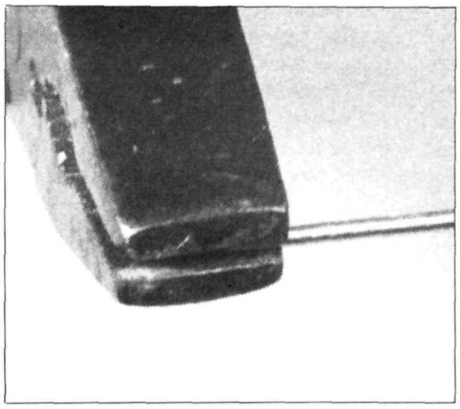
by RANDY RANDOLPH

MAKE A Z-BEND

A Z-bend in the end of a length of wire has been the standard way to connect control surfaces to an actuating device (servo, bellcrank, etc.) since the earliest days of U-control. It's not difficult to make, but it has given modelers trouble for years! The photos show an easy way to make it without special equipment.



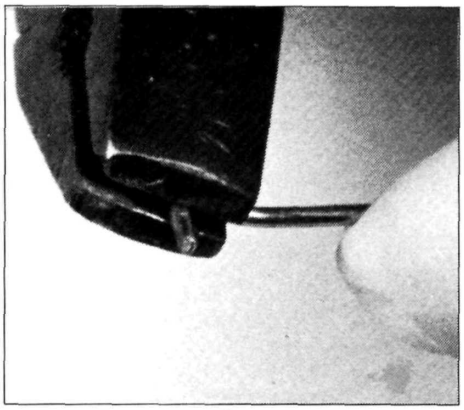
1.



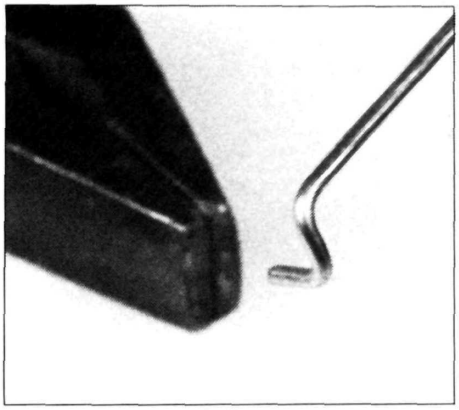
2.

1. The only tool necessary is an ordinary pair of pliers. The wire in this case is a piece of 1/16-inch brass rod that matched the holes in the servo output arm.

2. The first bend is a simple right-angle bend in the first 3/16 inch of the wire. All bends should be clean and the wire between them should be straight. The edge of the work-bench can be used in place of a finger when the wire is hard.



3.

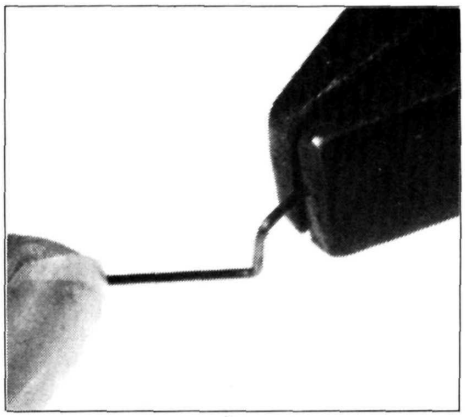


4.

3. The second bend is made 3/16 inch from the first and is at right angles to the first. Hold the first bend in the pliers and make the second one just as the first.

4. This is the way the end of the wire looks after both bends. It's a good-looking Z, but not yet what we're looking for.

5. The last bend is to straighten out the second. The pliers is moved out on the wire in this photo to show the last bend—actually, it should be much closer to the vertical part of the wire when the last bend is made.



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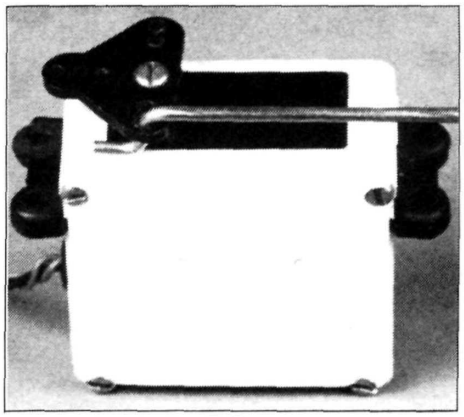


6.

6. The finished Z-bend installed on the servo output arm. The arm is removed to insert the wire, then reinstalled on the servo. Z-bends are easy!

GIANT STEPS

(Continued from page 54)

available cheap from drafting supply houses. A good variety of such curves is an indispensable help in laying out patterns.

Patterns can be laid out on clear acetate, or any other such material. I like to use a tinted material, because clear plastic film patterns have a tendency to disappear when they are laid down on the layout board. If you know an X-Ray technician, ask him for some unexposed, developed X-Ray film. It's great for this purpose as the emulsion side of it has some "tooth," making it is easy to draw on with almost any writing instrument. X-Ray departments test their developing machines from time to time by putting blank film through the developing process, so they usually have a supply of this material.

The material used for patterns should be thick enough to trace properly onto the building material, not too thin and not too thick. It's a good idea to mark each pattern as it is made in order to be able to duplicate any part which might be required in the future. The same thing applies to the parts themselves, of course. It's a lot easier to mark each part as it is cut than to have to figure out what it is later!

Another good way to transfer patterns to the building material is through the use of a bond paper copy of the part, taken from the plan. Once you have an accurate copy, it's a simple matter to lay the copy face down on the building material and apply heat to the back of the copy. Since copies are made by heat-fusing a plastic powder to paper, applying heat will melt the plastic onto the face of the building material. Take care here to assure that the copy is an accurate rendering of the original on the plan sheet. Many copiers don't produce completely accurate copies of the work being done. Nowadays, it's usually not a problem to find a copy shop which is able to make very accurate copies for you.

Once the patterns are transferred to the building material, start cutting the parts. Here again, accuracy is the key word. If you've traced the part from an accurate pattern, the size indicated is probably slightly larger than the original. Check the cut parts against the original on the plan to assure you've produced the correct shape and size. Remember the old adage, "Measure twice, cut once."

Care in making the patterns, in transferring them to the material, and in making the parts will pay off in an accurate, true, and well-made model. Lack of it can destroy a model before it leaves the workshop, or very soon thereafter!

Dick Phillips, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the persons and companies mentioned in this article:*

Clark Airscrew, RR #4, Tottenham, Ontario, Canada LOG IWO.

Forest Edwards, 12645 Amber Lane, Grass Valley, CA 95949.

DGA Designs, 135 East Main Street, Phelps, NY 14532. ■

SOARING NEWS

(Continued from page 69)

Soartech, *Herk Stokely, 1504 North Horseshoe Circle, Virginia Beach, VA 23451.*

Aerospace Composite Products, George Sparr, P.O. Box 16621, Irvine, CA 92714.

Viking Models USA, Jerry Slates, 2026 Spring Lake Drive, Martinez, CA 94553; 415-689-0766.

Dave Jones, Western Plan Service, 5621 Michelle Drive, Torrance, CA 90503.

Symposium Proceedings, *Walt Seaborg, 1517 Forest Glen Road, Oregon, WI 53575.* ■

SCRATCH-BUILD

(Continued from page 21)

If you don't have a large table to set the door on, make a frame out of pine 2x4s and be sure to support it in the middle so it won't sag later. While you're at the hardware store, pick up an outlet box with an extension cord so you'll have ready access to electricity.

Now you're ready to think about tools. Everyone has their own choice for tools, but the basics include a vise, a table sander, a hand drill, a saw, knives, razor blades, sandpaper, and a first-aid kit. For the assembly of any model you'll need waxed paper, pins, glue, a ruler, a metal straightedge, a triangle, and wood for building.

By the way, when you purchase plans, get two sets. You'll find that you'll be cutting them up for patterns, layouts, etc., and you'll need something for reference. Obviously you can't refer to the wing drawing if it's pinned to the table with half a wing built upon it. Talking about patterns, if you plan to make more than one airplane it's a good idea to make permanent patterns of the various parts out of plywood, metal, or a thick mylar. This way you'll always have them.

One way to make the various parts from the plans without cutting them up is by placing tracing paper between the plans and the wood and drawing the outline. For this I use a ball-point pen that has no ink in it so I won't mess up the plans. By the way, I always cut my parts slightly oversize. It's easier to trim a little bit off than to add it back on!

When drawing parts on wood, always pay attention to the grain direction shown on the plans. If none is shown, a general rule is to have the grain running in the direction of the longest dimension. For example a wing rib would have the grain running lengthwise instead of vertically. The exception to this rule is with fuselage bulkheads where cross-grain strength is needed. Even in these cases it's usually best to attach a stiffener or reinforcement to the bulkhead.

An important thing to remember when scratch-building is to leave the design to the designer. In other words give him credit for designing a structurally sound airplane. If you take it upon yourself to beef it up here and there, you might alter the wing loading sufficiently to end up with a big disappointment.

One of the best features about scratch-building is that it allows you the advantage of hand-picking your own wood. This can make a big difference, not only in weight but in strength. How much wood you'll need is a simple matter of calculation. Go over the plans and make a list of all the various sizes of wood shown. Start with the widest pieces and add up the lengths. For example, if you have more than one ¼-inch square balsa strip, such as for wing spars, add up the total accumulated length of all these pieces and divide by 36, which is the usual length of balsa wood found in the hobby shop. If it comes out to 8.3 pieces, make it 9 pieces total. Do the same thing with the balsa sheets that have a common thickness. To calculate the number of sheets you'll need for wing ribs, measure the length of the rib and multiply by the number of ribs (if they are equal lengths), divide by 36 (the length of your balsa sheet), and then divide that number by the number of ribs you can place on top of each other on a piece of 3- or 4-inch wide balsa. This is usually one or two. For example, if you have a rib that's 2 inches wide and 8 inches long and there are 30 ribs, 8 times 30 equals 240 divided by 36 equals 6.6 pieces of 2-inch wide balsa. Since ribs can be inter-nestled on a sheet, you could probably get by with 4 sheets of 3-inch wide balsa for the ribs.

Once you have your materials list prepared, make a list of all the accessory items you'll need, such as pushrods, wheels, hinges, fuel tank, wheel collars, motor mount, etc., and your covering material.

The assembly of a model built from scratch is no different than building one from a kit. Follow the directions. The plans sold by *Model Airplane News* are identified by number and the numbers tell the month and year of publication. For example the Aerofox is plan number 12861. This means that it was published in the December 1986 issue and was plan number one (month/year/plan). The construction article that accompanied the plans is a necessary reference source for your building project and I highly recommend that any time your order a set of plans you also order either a copy of that issue, if it's available, or a Xerox copy of the article. The construction article will in most cases answer any questions you might have about the design and how you go about building it.

Building a model from scratch can be a lot of fun, and isn't that what the hobby is all about? ■

Radio-Control

by ART SCHROEDER

POWER PONDERINGS. I love engines, I always have. Over this half-century of modeling that I've been lucky enough to have, the most lasting momentoes are the engines I've used. They certainly have outlasted any model I ever built and some still remain in my workshop cabinet.

Model airplane engines are (and always have been) jewels of the engineers' art and manufacturers' skill in precision production. That art and skill has progressed over the years to a point that today's engines are incredible in power output, balance, metalurgy and longevity. For anyone who enjoys machines, the modern model engine has got to be a real "kick." We have super two-cycles up to Super Tigre's 3000, a wide range of four-cycles up to 1.20 cid, Davis Diesel conversions, chainsaw conversions to 5 cubes, and multi-cylinder jobs of every description.

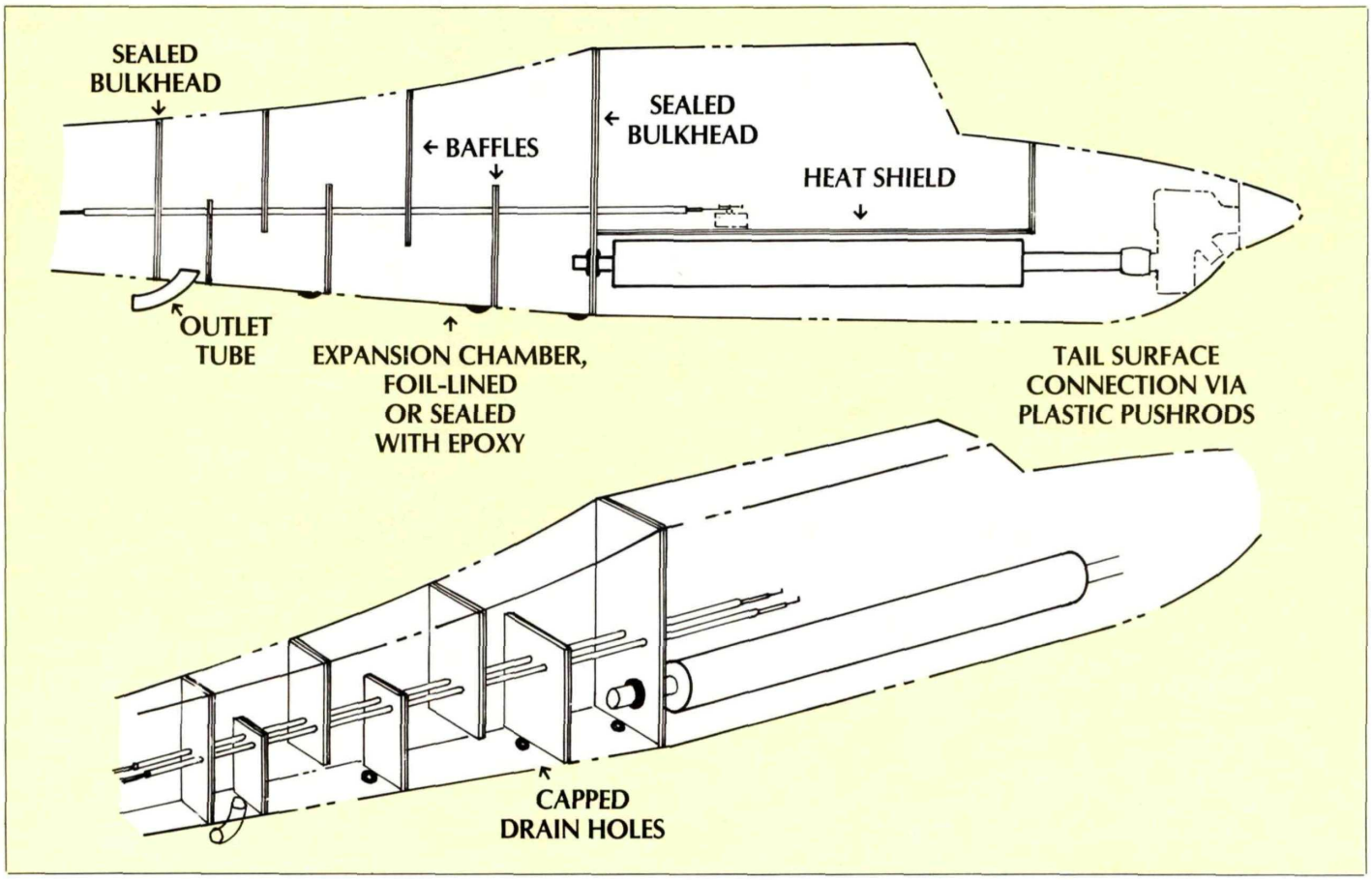
They are beautiful, powerful, efficient and—they are "killing" our sport! Why? Because every one of these mechanical gems makes noise and our "neighbors" don't like that.

Somehow, someway, we must make our act quieter. Of course we can go electric, of course we can go to gliders—and they are fine. But not every modeler (indeed most modelers) wants to give up those marvelous internal combustion powerplants. So, if we want to keep flipping the propeller we had best find a way to keep our noise to a minimum.

That is going to require a couple of things. The first is some real research on the part of engine manufacturers in the muffler area. It's possible to design mufflers that can really do a job. After all, I'm driving a car with 180 cubes and its noise level is well below that of my models.

And that research must lead to bolt-on equipment that can get our engines down to the lowest possible level. Generally, we're all sport flying with mufflers that are little more than expansion chambers. Certainly that helps, but it doesn't really do the job we need.

Second, to insure we use those future mufflers, it's time the AMA mandated an



One method of sound abatement would be to use the entire rear fuselage as a noise dampener. Complete fuel-proofing absolutely essential.

acceptable noise level as a requirement of membership and its intendent benefits. Sure, I dislike regulations in our over-regulated lives, but I would sooner have the AMA set a level than some governmental agency. Somehow, we must become better neighbors so we can reasonably fight those who would close us down for any reason. They are out there and noise is their catalyst for negative action against us.

I only wish I had the insight into thermal dynamics and therefore be qualified to speak about methods for quieting engines. I can't since I'm a "cut and try" modeler. But, I did give noise abatement a try some 10 years ago and the idea may still have some value.

All of us fly models that include near perfect spaces for large expansion chambers that have room for baffles and, a plus, one that is insulated from the environment. That near perfect area extends from the rear of our equipment compartment to the model's tail surfaces.

Think about it. There is an airborne space right behind your servos that could save flying fields. How can we use that space?

Well, it can be used with a little modification and oil-proofing of the wood. During construction, fiberglass resin can be used to seal off the wood. Nyrods make tail surface connections possible in a sealed chamber and a variety of baffles can be built in. All that would be needed would be a silicone tube connection from an exhaust manifold to a brass or aluminum tube of appropriate size epoxied to the rear equipment bulkhead. An outlet would, of course, be needed as well as a sealing bulkhead at the rear of the proposed expansion chamber. Indeed, a muffler box of wood or light metal could be custom designed for mounting in the proposed area. And, the area could also house a tuned pipe to take advantage of the sound insulation that the enclosing fuselage would provide (I've run a couple of tuned pipes internally mounted and insulated and the sound reduction is remarkable).

Is such an idea without any real foundation? Not at all! I tried the idea ten years ago in an Eyeball and it worked. I did not carry it any further because there was no pressure to do so, but the system was very quiet. However, there were some problems. There was some oil build-up inside the rear fuselage but this never caused a trim change and I drained the fuselage through capped relief holes after each flying session. I initially tried aluminum foil as the fuel-proofing element, and that is the best I've used, but epoxy also worked and was easier to apply. Heat (it drops well below the levels found at the exhaust outlet as it passes through the silicone tube) in this rear muffler compartment did cause a slight change in the nyrods—newer types of plastic pushrods, however, seem less susceptible to temperature-induced changes.

There was also some power loss. This was probably caused by the length of the connecting silicone tube from the exhaust to the compartment. The power loss was not much more than I had experienced with a typical bolt-on expansion muffler. Diesels and four-cycles would tolerate the inherent back pressure better.

There is also need for caution. All internal combustion engines can backfire and this could, potentially, cause a fire in the proposed compartment. However, engines using alcohol-based fuels are not particularly prone to the problem and, over the 10 or 12 inches the exhaust travels there is very minimal danger. It is certainly no more than an oil-covered nose catching fire from a belching exhaust. One would have to avoid flooding with subsequent forcing of raw fuel into the compartment. Aluminum foil covering in the chamber would further reduce any problem and there are heat and fireproofing liquids that one could experiment with.

Also, I would never try this idea with gasoline based fuels—that would be fool hardy and extremely dangerous.

Rear-exhaust engines would be most convenient to install this way, but a rear-facing exhaust manifold could be easily fabricated for side-exhaust engines. By the way, there is a similar large space in many cowls and between the firewall (below or above the tank) and the front of the equipment area.

I really think the sound advantage comes from a relatively large area for exhaust to expand and a few baffles to kick sound waves around a bit. Anyway, the arrangement I tried was quiet and may be something to consider.

Those Engines Do Last

I took out some of my personal oldies recently. One is an Ohlsson 23 from my teen years. There is also a Super Cyke and an Ohlsson 60; engines I flew in U-Control and Free Flight years ago. Although I have numerous other engines from the Thirties and Forties, I'm really **not** a collector and the ones I have the most feeling for are those I actually used to get started in model aviation. I fired up the 23 just to hear the old sound (it proved to be quite loud) and had a ball. Do you know, that old Ohlsson still turns out a fair bit of power; sort of like a very small chainsaw engine. At least the fuel was the same. What really surprised me was the engines' ease of starting. The newer ignition systems certainly help and, I guess, I've learned something over the years. Anyway, it was a memory-filled afternoon and I've got to find a way to again use those old engines. At least I will if I can quiet them down.

Omahawks One More Time

My vote for the club with perseverance plus in protecting its rights has gone, and continues to go, to the Omahawks of Omaha, Nebraska. This club (I can never forget their many marvelous Multi-Wing

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ENYA 30-HELI

(Continued from page 31)

cylindrical valve, through which fuel must pass to reach the jet and there is a bypass slot, in the wall of the sleeve, that allows this to occur without restriction at full throttle.

As the throttle is closed, the bypass slot is moved round so that it is out of line with the two holes. However, leading from the first hole, there is a tapered vee groove in the surface of the cylindrical valve that permits a reduced flow of fuel to reach the bypass slot. As the throttle barrel is rotated more toward the idling position, the tapered groove allows less and less fuel to reach the bypass slot. From the slot it passes into a channel around the end of the valve which communicates with the second hole, allowing the fuel to pass through the jet.

Study of the photograph of the carburetor parts will help clarify this description. It will be seen that, attached to the cylindrical valve there is a double-ended lever. This allows the cylinder to be rotated about 17 degrees either side of a central position. In this way fuel restriction at part throttle can be increased, or diminished, in order to maintain the correct mixture strength through the throttle range. Incidentally, the GM-Type has a substantially larger throat area than the standard airbleed type, which accounts for the higher power rating of the GM version of the engine.

The remaining parts of the two helicopter engines are basically the same as those of the 30-Ring model, described and illustrated in the October issue, except for the type of cylinder head and muffler used. Fittingly, the rectangular "heat-sink" type head has substantially greater fin area, but has the same bowl-and-squishband type combustion chamber. The shorter M301H muffler has two side outlet stubs of slightly less total area (39 sq mm) than the standard M251 type's single outlet.

Peter Chinn, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■

THE COCKPIT

(Continued from page 65)

interchangeable with earlier machines. With an eye toward reducing weight, every inch of the airplane was gone over and modified. An example of this type of modification was reducing the wheel size on the landing gear. This not only saved weight but allowed them to eliminate the characteristic cant in the wing root, which was necessary to cover the larger early model wheels and brakes. The entire skin pattern of the wings was changed and the super-heavy leading edge of the early wings eliminated in favor of a two-piece version that had a span-wise seam several inches below the leading edge.

Knowing that the back of the dog house was a high-drag area, they streamlined the lower fuselage and the resulting H model design was totally different in that area.

The most identifiable feature of the H model is the much taller and nearly pointed vertical fin, which apparently made the airplane much more directionally stable and was a better gun platform in almost all applications. This was the tail used in most of the Trans-Florida Cavalier civilian Mustangs marketed as high-speed personal transports in the mid-1960s.

There is something about the lines of the P-51H that doesn't go together as well as do those of its earlier brethren. Of course, this could be only in the eye of the beholder, since once you've established a favorite anything, a modification or change, like having a new group singing your favorite song, looks and sounds wrong, but the P-51H was by far the best performing of any production Mustang variant.

The Mustang was certainly one of the most effective weapons of WW II. But it would be a mistake to assume the most famous of that tribe was the only one which did the work. It was the A model that first established the airframe as being a winner and it was the B and C models that first carried the fight to the enemy. They were the first single-engine fighters to be seen over Berlin. Until the D models appeared in combat in late 1943, it was the B/C that did all the dirty work. In fact, the reason so few early model Mustangs have survived is because a much larger percentage of them went overseas than did the D models. Also, at the end of the war when the decision was made as to what airplanes should be made into beer cans and which would survive, the later variations of every breed were survivors. Thousands of early Mustangs wound up in the smelter.

It's not often that one is able to physically compare one model of a Mustang against another. However, the new Kermit Weeks Museum in Taimaimi, Florida, will eventually have A-, B-, and D-model Mustangs on display.

So, like I said, there are Mustangs and then there are Mustangs, and it's the details that make all the difference. ■

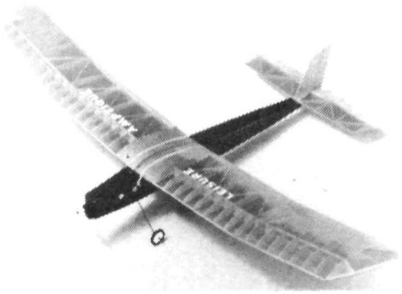
KYOSHO ROCKY

(Continued from page 53)

of the front suspension and drive components, followed by the rear. Once this is complete, you connect the front and rear components to the chassis, followed by

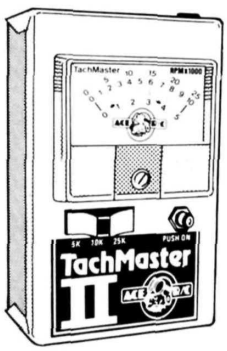
(Continued on page 94)

Product News



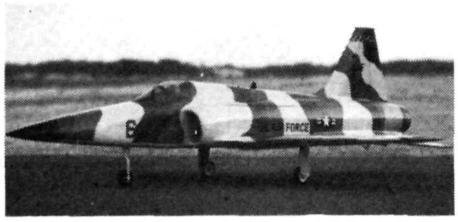
HANDS-OFF ELECTRIC R/C TRAINER

The Leisure Amptique is easy to build, even for the novice, and easy to fly too. A geared Leisure 05 stock motor provides a solid 5 minutes of climb power. By using simple On/Off switching, the Amptique's good thermalling capability will provide you with flights of up to 15 minutes long. Because the Amptique is electric powered, it's quiet. You can learn to fly at any school yard, park or parking lot and no one will know you're there. The Amptique also makes the perfect weekend, and workday, sport flyer. Specs: wingspan 61 inches, wing area 518 square inches, flying weight 35 ounces; powered by a Leisure 05 stock motor geared 2.5:1. For further info contact Roland Boucher, President (22971 B Triton Way, Room 21, Laguna Hills, CA 92653).



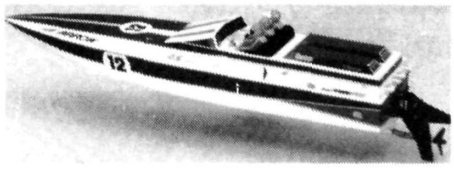
TACH MASTER II

Here's an improved version of the venerable TachMaster. With this tachometer, a photo diode cell detects rpm for safe and easy use (nothing to touch the spinner or prop). It has three separate ranges, 0-5,000/0-10,000/0-25,000 rpm and each range is indicated with a separate color for easier reading. Made with a quality meter and components for super-accurate readings! For more info contact ACE R/C (Box 511C, 116 W. 19th St., Higginsville, MO 64037).



AGGRESSOR

To capture the spirit of Top Gun enthusiasm, Bob Violette Models announces the availability of the Aggressor fan jet model. The Aggressor is a derivative of the popular and successful Sport Shark series and it features the same factory-built balsa and carbon-fiber wings and stabs. The fuselage, its separately molded hatches, inlet lips and liners as well as the tail pipe are made of light epoxy glass and Kevlar. The location and perfect alignment indexes for the wing, stab and fin are molded into the fuselage, making the assembly of a straight and true airplane a sure thing. Because of extensive use of carbon composites in this kit, the wing is easily removed to facilitate transit and storage. Speeds of 150 mph in level flight, straight-up climbs to over 1,000 feet, excellent slow flight stability and grass field operation without a cheater hole or oversize inlets make the Aggressor a very special jet model. Power is via the patented Viojett fan system and KBV .72 engine. For the complete Viojett product information package, send $3 to: Bob Violett Models (1373 Citrus Rd., Winter Springs, FL 32708).

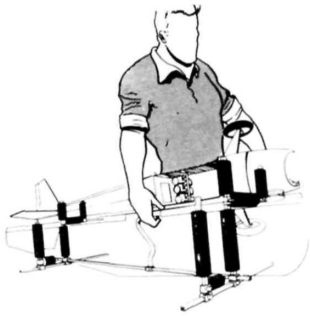


ARROW FASTBOAT

The Arrow twin-electric fastboat is a highly prefabricated kit for fast offshore R/C racing and was designed specially for Graupner's Monster electric outdrive system. Arrow is 31.5 inches long with an 8-inch beam, and is fully described along with hundreds of other new items in Hobby Lobby's new catalog Vol. 8. For this FREE catalog, write: Hobby Lobby (5614 Franklin Pike Circle, Brentwood, TN 37027).

CONQUEST 5NLP/PCM

Futaba has responded to the demands of top pattern fliers with the incredible PCM, the most sophisticated radio control system available. The Conquest 5NLP is the first system in its class to use Futaba PCM, the same, exclusive Pulse Code Modulation microprocessor made famous by Futaba's conquest fliers in competitions around the world. Now Conquest 5NLP gives sport flyers the extra control, confidence and reliability only Futaba PCM produces. System specs: Five-channel PCM features adjustable dual rates (2), R105IP/five-channel receiver, NiCd batteries, four S138 servos, servo reverse (5), 50, 53, and 72 MHz. For more info on this product contact Futaba Corp. of America (555 West Victoria St., Compton, CA 90220).



SUPER CRADLE

If you're tired of trying to support your aircraft on boxes and brick as you work, then this is the tool for you. Made of strong tubular steel and painted to protect against corrosion. You can assemble it in many different ways to better support your aircraft. Uses include—MonoKoting, sanding, painting, installing radio, assembling plane at the field, preflight, clean-up. For more info contact ACE R/C (Box 511C, 116 W. 19th St., Higginsville, MO 64037).

TRANS-COVER

Fliers from all over the world are discovering this neat and inexpensive way to protect their radios from dust, dirt, rain, balsa dust—or just plain grunge. Now your club can have its logo or insignia printed on this great promotional item. Colors: kelly green, cobalt blue, bright red, bright yellow, bright orange, midnight black. Contact K.D. Graphics (P.O. Box 9212, Columbus, GA 31904).

THE MRC BLACKFOOT!

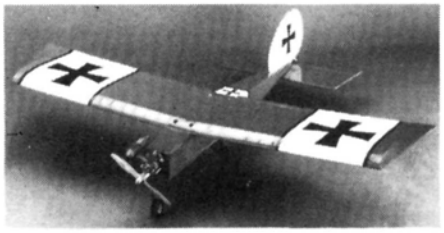
This 1/10-scale two-channel truck has got what it takes. Its massive 5-inch-diameter tires named this vehicle as their monster tread sits at all four corners. The ABS-resin space frame keeps the chassis light and strong, and easy to build. The thick resin bumper protects the chassis and pushes minor obstacles aside. A powerful Mabuchi RS-540S motor was chosen, hooked to a 3-step forward and reverse speed control. A sealed gear box with a differential puts the power through rubber-boot-covered hex universal joints to the rear wheels for torque and speed. The body is the rugged Ford F-150 pick-up, with the accurate detailing only found on MRC/Tamiya injection-molded plastic parts. Contact MRC/Tamiya (2500 Woodbridge Ave., Edison, NJ 08817) for more info.

KYOSHO ULTIMA

A year of strenuous research and testing has given the Ultima a new state-of-the-art design. An impressive list of standard features is highlighted by the Ultima's super-tight, super-durable monocoque aluminum frame, four oil-filled Kyosho shocks and a heavy-duty power train. The EX-66 nylon suspension system that made Kyosho's four-wheel-drive Optima such a success has been adapted and improved for the Ultima. Other stock features include an aerodynamically functional wing and low-profile pin-spike tires. The Ultima has been designed and engineered to set the industry standard in two-wheel-drive off-road competition. The Ultima is distributed by Great Planes Model Distributors (P.O. Box 4021, Champaign, IL 61820).

PIC 'N PATCH FILLER

A fast-drying, lightweight, fluffy paste to repair scratches, nicks, dings, joint buttments, and the like during construction and prior to final finishing, whether painting or using heat-shrink coverings. Excellent for use on balsa, hard woods, fiberglass, plastics, cardboard, and most porous surfaces. Apply in thin layers, sands within minutes, dries without shrinking or cracking. Thin with water to vary consistency, no solvents to evaporate or dry out. Superb shelf life. Tint with water-based dyes and pigments. The filler is sold in 8 fluid ounce (½-pint) wide-mouth tubs to permit easy stirring and putty knife application from the container. Contact Penn International Chemicals (943 Stierlin Rd., Mt. View, CA 94043).



BIG STIK SERIES

Great Planes Model Mfg. (P.O. Box 721, Urbana, IL 61801) announces production of the new Big Stik series kits, available in .20, .40 and .60 size. These kits have a lot of wing area and beefed-up fuselages that make them ideal for today's hot Schneurle-ported engines and the popular (but heavier) four-cycles. The kits boast hand-selected balsa and ply, aluminum landing gear, fiberglass-filled nylon engine mount, steel rod-in-tube pushrods and complete special hardware, plus rolled plans and an exceptionally easy to understand step-by-step illustrated instruction manual. Parts for both trike and tail-dragger are included. These kits are recommended for any novice to advanced modeler who wants a great-looking, great-flying model with a minimum of building time and effort. For more info on the Big Stiks and a free catalog of the entire Great Planes line of fine kits, contact Great Planes Model Mfg.

SINGLE-STICK PCM

This professional system includes an ultra-precision stick, interface protection of pulse code modulation (PCM), integrated battery continuous monitoring, fail-safe alarm, mixing of any two out of seven channels, and more. Also includes R118GP receiver, four S-130 servos, dual-rate/VTR (3), ATL, ATV, DSC, servo reverse, tachotimer, Ni-Cds, and 50, 53, or 72 MHz modules. Contact Futaba Corporation of America (555 W. Victoria, Compton, CA 90220).

KYOSHO ROCKY

(Continued from page 90)

the assembly of the wheels and the radio installation.

Your next task is to paint the body. For the windows I used a black paint marker from MRC/Tamiya*. With a little slight of hand, this task can be accomplished without the use of masking tape. The next step was to finish off the body with a base color. For this I used the vibrant yellow Parma* paint. This is one of the best paints to use on R/C cars because of its resistance to cracking and pealing. To use the Parma paint requires the use of an airbrush. If you don't have this kind of equipment, regular spray paint will suffice. The rest of the colors and other visual effects are supplied in the decal kit.

Now you're ready to do some rompin' with the Rocky!

PERFORMANCE. As I stated before, the only thing that's beginner-like about the Rocky is the assembly. Before any pictures are taken I like to take a car out and give it a dry run. But the Rocky's maiden voyage was far from dry! To avoid any damage I usually take a car out on the street and give it full throttle the full length of the street. This time was no different except for two variables. The first was that the sides of the street were lined with puddles from a recent rainstorm. The second was that I forgot to turn on the transmitter prior to turning on the switch for the receiver. The end result of this was the Rocky heading full steam through a series of, you guessed it, puddles. I thought for sure that this was to be the demise of the car, but, to my surprise, it just kept on goin'!

After an exhausting foot chase, I finally caught the Rocky and drained it of the water it had taken on. I then turned on the receiver switch and began foraging through a neighbor's yard. The Rocky had no problem with any of the obstacles it encountered, including a railroad tie that stood about 5 inches out of the ground. Although it slowed it down a little, with the aid of the four-wheel drive the Rocky cleared it with ease.

Next was the photo session. The location was an abondoned moto-cross track, which was littered with rocks 3 to 5 inches in diameter. It made for some awesome photos, but the Rocky was up against some serious obstacles.

After some still photos, I cut the Rocky loose on the track. The rocks that it didn't slither right over, it just plowed out of its way. After the dust settled, I thought for sure that the Rocky had to have some kind of damage. I was awestruck to see it sitting poised and ready for another run through the land of doom. For obvious

(Continued on page 97)

Pattern Matters

by MIKE LEE

THIS MONTH we'll begin our workshop discussion on the subject of retracts. In my book, there are two types of retracts—those that retract and those that don't. But that may be an oversimplification.

In all fairness, though, there are actually three types of retracts. They are mechanical, pneumatic (air driven), and electric. All three types can fail, but each has a different failure mode.

The first type, the mechanical, is actuated with a servo pushing or pulling a pushrod connected to the retract. The installation of the mechanical type must be fairly precise in order to allow consistent action. When done correctly, this type can be one of the most dependable and trouble-free.

To install the mechanical retracts you must use a 180° rotation retract servo to operate them, and that normally means a rather fussbudget pushrod. Because the servo rotates 180°, the amount of throw on the pushrod may not be quite right on the button to make the retract lock up or down.

The key is to place a 180° bend in the pushrod near the servo (see Figure 1). The bend in the pushrod will do two things for you: one it will allow the pushrod to bend around the servo arm without hanging up, and two it allows some give or take if the throw is excessive from the servo. It acts somewhat like a spring. Should the servo throw too far, the bend will simply compress and allow the servo to finish its rotation without stalling. The same is true if the servo pulls too far—the rod will give some to allow movement. Most importantly, you must avoid stalling the servo, which can cause a massive power drain on the battery.

Another pitfall on mechanicals is attempting to deploy the gears in any position other than upright. As this type of retract depends on a counterbalancing spring to assist the action, a gear deployment in the inverted position (like a hot-dogger would attempt) would stall the servo and drain the battery excessively. You must also make sure that no part of the retract drags against anything that could prevent the wheel from coming down.

To summarize, mechanical retracts are probably the most dependable retracts when set up correctly the first time, but are also the fussiest to initially set up. Prevent any drag on the gears, don't deploy except when upright, and put a good bend in the pushrods. Once the initial setup is done, you'll probably never need to adjust them again.

The second type is the pneumatic or air-driven retract, which is actuated by air pressure. One brand uses pressure to bring the gear up and an internal spring to bring the gear down when the pressure is released. In any case, it is fairly easy to install, and very dependable when properly maintained.

New for pattern circles is Hanno Prettner's Supra-Fly in EZ kit form from Hobby Shack.

Although pneumatics don't need the 180° rotation servo as the mechanical type does, they do require a standard servo to actuate the air valve.

The retract and valve units require lubrication for proper operation, and with neglect the rubber seals inside will dry out and leak air. The result then is a lack of air pressure to either retract or deploy the gear. As for the spring-deployed retracts, the worst that would happen here would

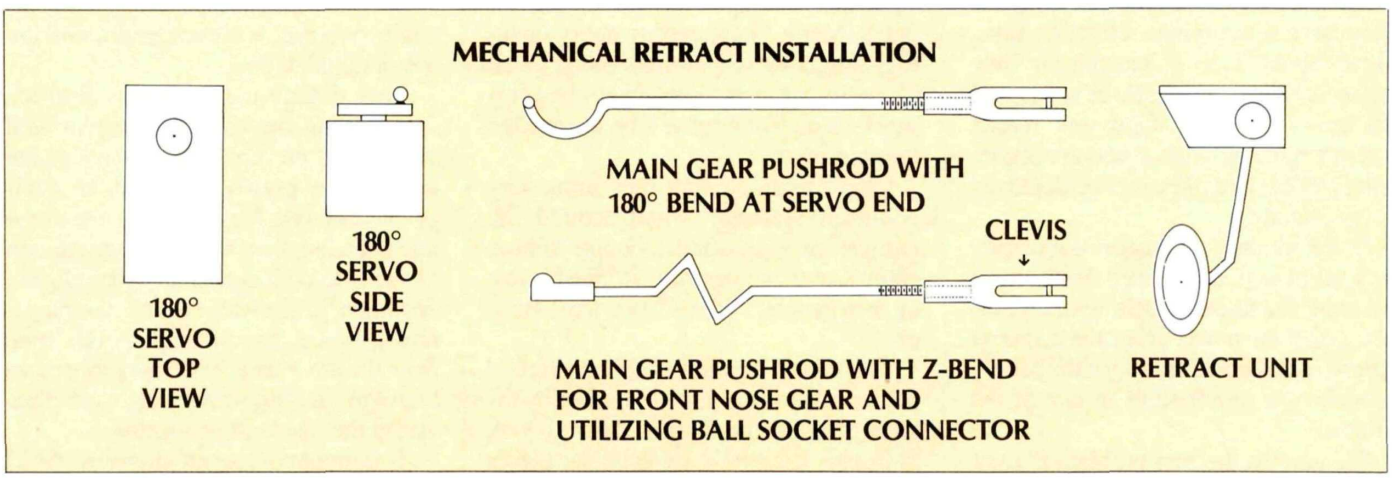


FIGURE 1

be the slow but sure deployment of the gear during flight as the pressure dropped.

To prevent this from happening, most pilots simply pour oil into the air lines and pressurize the system a few times. However, the oil will soon disappear and you'll find that you're lubing the retracts often. If you choose to use freon to pressurize the system, you'll lose oil even faster and then torture the seals by freezing them.

A better way to lube the seals is to use standard petroleum jelly. This lube will withstand much more abuse inside the pressurized environment without blowing out. It's also very easy to inject into the cylinders where the seals are.

My method of getting the jelly where it belongs is to merely stab the tip of the air hose, the end connecting to the retract unit, into the petroleum jelly until an inch or so is stuck inside the hose. Then, simply re-attach the air hose to the retract and pressurize. The air will force the jelly into the cylinder and the retract is lubed.

As for the air valve, all one needs to do is stuff some jelly into the valve and work it a few times. Using this method and lube, your service interval should be much longer before lube time is up.

To summarize the pneumatics: they're easy to install, dependable when serviced, and very strong. They will deploy in virtually any attitude with a most assuring "flop pop." Just remember to lube them, prevent any type of drag, and re-lube them. I also recommend this type to pilots with no prior experience in retractable gear installations.

The last type of gear is the electric. This type is a self-contained unit in that it generally requires no actuating servo. Instead, its own amplifier plugs into the receiver, as would the servo. This type normally uses power from the airborne battery pack, and is probably the easiest of any to install and use.

The electric retracts have some virtues. They have a scale-like retraction time, taking about 2 to 4 seconds to fully deploy or retract. They also have internal clutches which will allow the retract motors within each unit to operate despite being stalled. And they can be deployed in any attitude.

As for the disadvantages of electrics: they're heavy compared with their mechanical and pneumatic counterparts; they pull their power from the airborne battery, which could be risky if the battery is weak or a motor stalls in one of the retracts.

The cure to the first problem is easy, but as for the problem of weight, there is nothing you can do about it. As far as the battery problem is concerned, you can wire-in a separate power source to drive the retracts separately from the receiver. A small 100-mAh pack will suffice.

To summarize electric retracts: they're very dependable and easy to install, scale-like in action, and strong. They do weigh the most and can present a power drain problem if not adjusted correctly.

That does it for our description of retracts. All three types have pros and cons, and all are capable of failing. The rule of thumb on all of them is to keep them adjusted correctly, avoid any type of drag on the gears, and maintain them frequently.

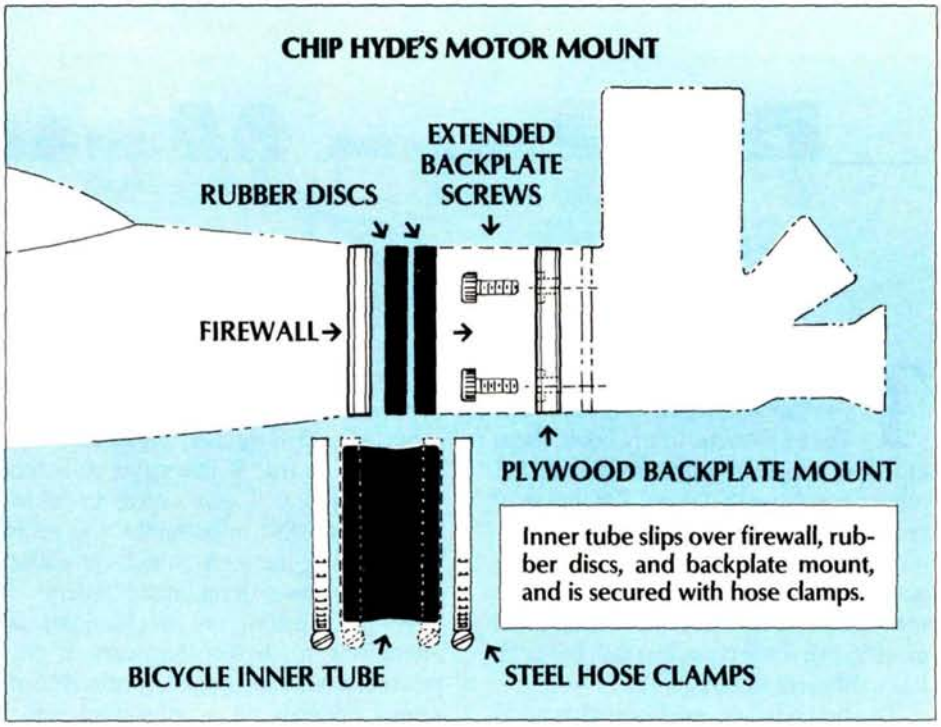


FIGURE 2

Try This Motor Mount

I have an idea this month from former Nationals Champ Chip Hyde, and his father, Merle. I happened to notice on his FAI ship, a Rossi-powered Dalotel, that his motor vibrates violently at idle yet is super-smooth otherwise. The secret is the motor mount.

Chip's motor mount uses some very common material found around the garage: some plywood, a couple of hose clamps, and an inner tube from a bicycle or motorcycle. "What?" you say? Read on.

The motor mount is simply two round pieces of plywood joined together by the inner tube. Let me explain. Taking a look at Figure 2, we have two circular pieces of plywood large enough to fit to the rear engine plate of the engine. Coincidentally, they're also just larger than the inner tube inside diameter. The hose clamps must be just large enough to encircle the plywood and tube.

Now, start by taking the first plywood dot and marking crosshairs on it. Using the crosshairs, epoxy the dot to the firewall of the plane so that it will be centered on the firewall where the engine will mount. Taking the other dot, mark the dot with crosshairs and then mark the locations of the backplate screws from the motor. This is done by simply placing the motor on the dot and marking its position.

Now, drill holes where the backplate screws were marked and countersink the hole. Locate some screws that will fit the backplate of the motor plus the thickness of the dot. The thickness of the plywood is ¼- to ⅜-inch thick, depending on the size engine you use. A .60 size engine will use a ⅜-inch-thick dot.

After drilling the dot, screw it to the motor using the extended screws with washers to prevent compression of the wood. The plywood should be fuel-proofed as well. Now, find the inner tube and cut a length of the tube long enough to slip over both dots, thereby joining the engine to the firewall. Before clamping it down, make two more dots, this time from the inner tube. Place the rubber dots between the plywood dots, and then clamp the whole thing together.

This mount allows mounting in a 360°

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KYOSHO ROCKY

(Continued from page 94)

reasons the Rocky had some scratches on its belly and a thick coat of dust, but had sustained no damage.

So, if you're a beginner looking for some big-league performance, the Rocky is the way to go!

**The following are the addresses of the companies mentioned in this article:*

Great Planes Model Distributors Co., P.O. Box 4021, Champaign, IL 61820.

Futaba Corporation of America, 555 West Victoria, Compton, CA 90220.

MRC/Tamiya, Model Rectifier Corp., 2500 Woodbridge Ave., Edison, NJ 08817.

Parma International, Inc., 13927 C Progress Pky., North Royalton, OH 44133.

For more dynamic and action-packed R/C car reviews, or for more information on all phases of R/C car modeling, check out Model Airplane News' *sister publication* Radio Control Car Action. *To order a subscription, credit card holders only can call toll-free 1-800-435-0715 (or 1-800-892-0753 in Illinois). Or you can send $13.95 for six issues, $24.95 for 12 issues to* Radio Control Car Action, *P.O. Box 427, Mt. Morris, IL 61054.* ■

O.S. MAX-61RF.ABC

(Continued from page 33)

Second, whereas, in common with most other .60 size engines, the previous O.S. motors in this category used an "over-square" bore and stroke combination of 24x22 mm, the new engine has "under-square" dimensions of 23x24 mm, to achieve the longer stroke configuration traditionally associated with increased torque at reduced rpm. To provide the necessary clearance between the piston skirt and crankshaft counterweight at the bottom of the stroke, the connecting rod is lengthened from 40 mm to 42 mm and this also keeps rod angularity and piston side thrust within bounds at a rod-length to piston-stroke ratio of 1.75:1.

As fitted to the Max-61RF.ABC illustrated, a ringless aluminum piston is used in conjunction with a convergent bore brass cylinder liner having the now well-known O.S. electroless ultra-hard composite plating on all surfaces. Porting is a conventional, but more conservatively timed, Schnuerle-plus-third-port system. A centrally bridged exhaust port, at the rear, opens for a measured 144 degrees of crank angle and is flanked, on each side, by transfer ports (open for 114 degrees) that are inclined slightly upward, as well as being angled away from the exhaust port and toward the third port located at

(Continued on page 98)

O.S. MAX-61RF.ABC

(Continued from page 97)

the front of the cylinder. The third port is inclined sharply upward and is open for only 104 degrees of crank angle. The liner has a very thick (2.5 mm) wall which is an aid to inducing an angled gas flow through the ports. It also leaves open the opportunity for the manufacturer to introduce a larger displacement version of the engine, at a future date, if required. The pressure cast cylinder head has a bowl-and-squishband combustion chamber and provides a nominal (full stroke) compression ratio of 11.8:1 (our measurement).

The crankshaft has a big 17 mm diameter main journal and an 11.7 mm gas passage that is gas-flowed where it meets the 17 mm long rectangular rotary valve port. The valve opens at 35 degrees ABDC and closes at 50 degrees ATDC. The shaft runs in a 17x30 mm 11-ball steel-caged bearing at the rear and a 3/8x7/8 7-ball steel-caged shielded bearing at the front.

The standard carburetor fitted to the Max-61RF.ABC is a new O.S. model, the Type 7L. This is an adjustable automatic mixture control type similar to the 7M fitted to the most recent versions of the 61FSR, 61VF and 61VR. Like the 7M, it has provision for manually setting the automatic mixture control valve that meters fuel admission through the entire throttle range. However, it lacks the separate mid-range overriding manual adjustment that is a feature of the Type 7M and Type 7H (helicopter) carbs. Why this refinement has been omitted from these latest engines is not known. We would hazard a guess that the reason is the same as has been evident, many times in the past, when manufacturers have provided an extra control to facilitate additional tuning of the carburetor to cover all possible contingencies. Past experience has indicated that, for every customer who appreciates such a feature, another one fails to understand how to use it and succeeds only in upsetting an otherwise acceptable adjustment. In such cases, it may be better for the manufacturer to omit the extra control and settle for a foolproof design as standard equipment, possibly giving the purchaser the option of the more complex carburetor should he wish to have it.

In addition to the Max-61RF.ABC and 61SF.ABC, the new O.S. long-stroke range includes helicopter versions of both models, plus four more powerful versions equipped with diaphragm pump pressurized fuel systems and enlarged choke carburetors. More about these in a future Round-Up.

Peter Chinn, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■

SMALL STEPS

(Continued from page 13)

In my next column I'll survey three currently-available kit designs for small sport-type R/C models: Ace R/C Inc.'s "Ace High," "Whizard," and "Pacer." All were designed by the late, great Owen Kampen, and are powered by .049 motors.

Don't forget to write, either to me or to Randy Randolph, telling us what *you'd* like to know, or see in this column.

Joe Wagner, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■

PATTERN

(Continued from page 96)

direction of the motor. It also feels very loose. But you'll find that it's very smooth-running when the engine is at speed. You'll also find that you can adjust the motor thrust setting by simply inserting a piece of rubber between the plywood dots and deflecting the mount. The resulting motor mount is not only cheap and simple, but transmits very little vibration to the airframe. You really have to see it to believe it. Try it and see.

Till next month, we're on the pipe and airborne.

Mike Lee, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■

ABOUT ENGINES

(Continued from page 57)

Between 1950 and 1962 there were thirteen American manufacturers making .049-size model engines. Today there's just one: Cox Hobbies*.

I think one reason few modelers fly ½A R/C these days is that they don't see it done successfully. When people get used to building models out of "Lite-Ply" and covering them with iron-on plastic, their ½A models are going to come out much heavier than they should. Then, with a 5½- or 6-inch prop on the motor, more noise than useful thrust will result.

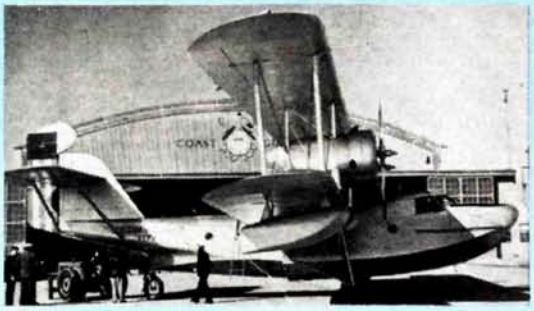
Here's my prescription for fun-filled R/C flying with .049 engines. Use a Black Widow or a "Tee Dee." Either can be throttled if you want: the Widow with a Cox or Ace "Throttle Sleeve"; the Tee Dee with a Tarno carburetor (available from Ace R/C). However, the Tee Dee won't idle unless you use a Cox QZ muffler along with the carb; and the Widow will only go down to about 5,000 rpm reliably. Thus mostly I don't bother with trying to control ½A engine speed. I fly full bore until the engine quits, then glide around and land deadstick. (This also saves the weight and cost of a throttle servo.)

(Continued on page 112)

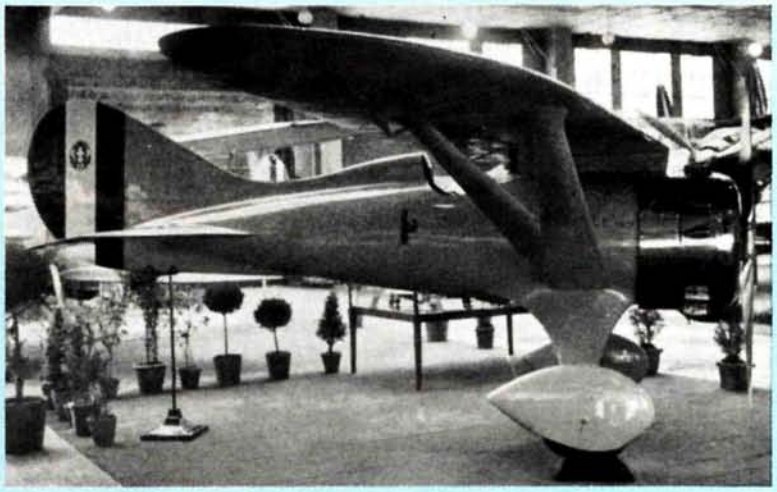
NAME THE PLANE CONTEST

Can you identify this aircraft?

If so, send your answer to Model Airplane News, Name the Plane Contest (state issue in which plane appeared), 632 Danbury Rd., Wilton, CT 06897.



The winner will be drawn four weeks following publication from correct answers received by postcard delivered by U.S. Mail. If already a subscriber, the winner will receive a free one-year extension of his subscription.



Steven A. Hall of Warwick, Rhode Island, correctly identified our mystery aircraft for December 1986 as the Hall PH-3, an airplane built for long distance rescue and coastal patrol by the U.S. Coast Guard in the 1930s. Powered by two Wright R-1820 engines, the ship had a wingspan of 72 feet, 10 inches, and a length of 51 feet. Seven were built.

Other correct entries were received from Ed Jecha and F.D. Wolfe.

ABOUT ENGINES

(Continued from page 110)

Use a 7x3 prop and Cox Racing Fuel (or an equivalent quality glow fuel with at least 25% nitromethane). Add about 3 ounces of castor oil—medicinal castor is fine—to each quart of fuel, for "lean run" insurance.

As for the model, a wing area between 200 and 300 square inches is best. Watch the weight! Stay between 22 and 28 ounces ready-to-fly. Too heavy, your airplane will be lifeless; too light, it can only be flown in calm weather.

Lilliputian R/C models have been flown successfully. I've seen a few powered by the microscopic Cox .010, an engine that's now a collectors' item. But airplanes this small have big problems. Even the .020 motors are hard to work out a truly practical R/C model for. Sure, very lightweight R/C equipment is available, and both the Cox Pee Wee and Tee Dee .020 put out respectable power. But flying a too-tiny R/C model is like sailing a walnut-shell boat: the least bit of turbulence can be mighty upsetting.

If you'd like to use an .049 engine to power a 2-Meter glider, such as Gentle Lady or a Metrick, a "power pod" installation above the wing will put out more thrust than a motor-on-the-nose setup. A lot more!

One more item on ½A R/C: the stock Black Widow fuel tank will run the engine about 3½ minutes on a 7x3 prop. To get more time, you don't need to alter the Cox tank to get access for an external fuel supply. Instead, put a 1- or 2-ounce plastic tank in the model, with two outlet lines: a feed and a vent. Connect the feed line to the lower tube coming out of the Black Widow tank. Now you can fill both fuel tanks via the upper tube in the Black Widow tank. First the engine tank fills up;

(Continued on page 113)

Club of the Month

Cheyenne, Wyoming, is a place where you can find cowboys, nice people, beautiful country, and the Cheyenne Hillhoppers, the *Model Airplane News* "Club of the Month" for February 1987.

This club has a long history, starting out in 1939 as the Cheyenne Model Airplane Club. Charter member Jack DeFond was a young boy but still managed to get some flying in with his Guff after much trial and error. His engine was a Maytag!

The club went through a period of moratorium during WW II, but started up again in 1945 as the Cheyenne Gas Model Association, formed by Charley Bristol and Bob Eldridge. The club held their first contest in September 1946 with events that included free flight, control line points, and control line speed. Bill Grove took fifth place in free flight, something he has been trying to duplicate ever since.

M.A.N. editor Dan Santich attended several contests sponsored by this club in the early '70s and can attest to the group's dedication to good sportsmanship and hospitality. Like club president Vince Defler says, when you fly at 6,000 feet, you've got to have a sense of humor! Newsletter editor Ina Treusch, wife of vice-president Mel Treusch, does a fine job of keeping all members informed of the club's activities in *Hopper Jabber*.

Model Airplane News applauds the Cheyenne Hillhoppers and is pleased to award two free one-year subscriptions, which are to be given by them to their outstanding junior members.

Congratulations!

Each month Model Airplane News will select the club newsletter that best shows the club's activities and energies directed toward the furtherance of the hobby. The award is not based on size or quality of the newsletter, and can be about any aspect of the hobby (F/F, C/L, R/C, boating, cars, etc.). Model Airplane News will award two free one-year subscriptions to be given by the club to outstanding junior members. So send your newsletter to Model Airplane News, Club of the Month Contest, 632 Danbury Rd., Wilton, CT 06897.

then its overflow through the lower tube fills the plastic tank. When fuel runs out of the plastic tank's vent line, cork the tube you filled through with a piece of sealed-off fuel tubing. The engine will now run until both tanks are empty.

Joe Wagner, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the companies mentioned in this article:*

Ace R/C Inc., 116 West 19th Street, Higginsville, MO 64037.

Cox Hobbies, Inc., 1525 East Warner Ave., Santa Ana, CA 92705. ■

HOBBY SHACK P-51

(Continued from page 42)

If there were one option I'd like to see available in this kit, or really in any of the EZs, it would be to make the kit available in a base color, like white, that would accept and retain a builder-applied finish. This would let the builder personalize his airplane and practice weathering and marking techniques, while still retaining the super flying characteristics and ease of assembly features. How about it, Hobby Shack?

About the only thing I didn't care for (and once again purism rears its head) was the weathering built into the finish. It was overdone, and could have been more subdued. But I suppose nothing's perfect and that's pretty much all I could find to squawk about.

I don't know what's planned to come out of the EZ Warbird hangar next, but if it follows what's already there, like the P-51 and FW-190, they've got to be winners! How about a P-47...a 109...a Corsair...or maybe a Zero?

All things considered, the EZ P-51 looks great, flies super, and gets you airborne quickly. Get one!

**The following are the addresses of the companies mentioned in this article:*

Hobby Shack, 18480 Bandilier Circle, Fountain Valley, CA 92728.

Pacer Tech, 1600 Dell Ave., Campbell, CA 95008.

Airtronics Inc., 11 Autry, Irvine, CA 92718.

Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820. ■

R/C NEWS

(Continued from page 89)

Championships for biplanes) has been in the front trenches for modelers' rights and field preservation for years—not without a few casualties. But they have persevered and recently responded to my November '86 column on flying fields. The respondent was Ron Van Overen, Omahawks president:

"Through phone calls around the country to other modelers to gather information

(Continued on page 114)

(Continued from page 113)

to fight all of these battles, I began to realize that the most success lies in public or joint-run facilities.

"We have a 10-page written agreement with the City of Omaha and the U.S. Army Corps of Engineers. We have formed a separate land corporation, Hawk Land Co. Inc., and purchased 10 acres of land adjacent to the federal park property. We have negotiated about $8,000 worth of free land from excavating through the U.S. Marine Corps and the U.S. Air Force and, most importantly, we are building a first-class R/C flying facility *with* our city's support."

Beginners' Corner

I've recently seen planes with left thrust in engines, huge gaps on hinged surfaces, unbelievable wing warps, vertical stabilizers at rakish (but aerodynamically poor) angles to the horizon stab, rearward balance points, wings and stabs skewed to each other, engines with (if you can believe) up-thrust, wing and tail surfaces set at obvious wrong angles, wheels set at screwy angles, switches and charging jacks being saturated with exhaust oil—and the horror list seems endless. Also, some of the atrocities were committed by modelers with more than a few years' experience! What makes me smile—and look for shelter—when one of these aircraft fly is the builder/flier's statement, "This damn thing won't fly right." Please. The instructions were in the box—you just didn't read them.

Anyway, next month I'll try to help with a series on setting up for the first flight.

Art Schroeder, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■

MODEL AIRPLANE NEWS

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WANTED: T-2 Buckeye ducted-fan kit or plans originally by D&B Model Aircraft. Ron Hodges, 2316 Oakbark St., Miamisburg, OH 45342.

FOR SALE: *Flying Aces* 1935-1944, *Model Airplane News* 1931-1960, others. $1 for list. Bruce Thompson, 328 St. Germain Ave., Toronto, Ontario, Canada M5M 1W3.

BOOKS FOR MODELERS. Out-of-print/current, 400+ items list $1. John Roby, 3703B Nassau, San Diego, CA 92115.

NYLON MACHINE SCREWS, nylon wire ties, polyethylene glue guns. Free lists. Transmotions, Inc., P.O. Box 160M, North Hollywood, CA 91603.

AIRCRAFT RESEARCH: Need rare aircraft documentations, photos, three-views? Send requests with $1.50 U.S. for sample information. Mr. I.A. Ross, 1447 Helm Crt., Mississauga, Ontario, Canada L5J 3G3.

FIGHTERS! Most complete collection of aircraft prints, posters, and postcards. Free catalog! MACH-3, Box 1390C, St. Louis, MO 63188.

ATTENTION, COLLECTORS: For sale, Brazilian-produced WB diesel and glo engines, 1.5cc, 2.5cc, .35. Price U.S. $150/part. Udo Eugen Linke, Caixa Postal 24 18130-Sao Rogue, S.P., Brazil.

OLD TIMER SUPPLIES, everything you need, plus custom engines, parts. Immediate service. Detailed brochure: $1.00. Kustom Kraftsmanship (MAN), P.O. Box 2699, Laguna Hills, CA 92654.

ELECTRIC KITS & EQUIPMENT: Specializing in Astro Flight Systems. Send $1.00 for catalog, refundable. CS Flight Systems, 31 Perry St., Middleboro, MA 02346.

MODEL ENGINES, IGNITION AND GLOW: collectors, runners, used, new. Sell, trade, buy. SASE for engine list. Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555. 619-375-5537.

R/C MODEL SIMULATOR: Enhanced performance. Flight Simulator for novice. Also teaches critical pre/post flight procedures. Commodore 64, disk, joystick. Send $5, diskette and SASE (or $8 and I supply) to J. Lane, 20163 Woodbend, Northville, MI 48167.

YEAR BOOK PRICES will increase 10 to 20 percent after January. Reason? Increase in re-printing cost. Send $1 for 16-page Index which lists contents of all 15 books. Model Aero Pubn., Box 135, Northridge, CA 91328.

ELECTRIC STARTER PARTS WANTED: Eastcraft System 201 "Lectra-Starter," new/used, particularly clutch and drive gear. William B. Dickinson, 6126 Bell Station Rd., Glenn Dale, MD 20769.

PRIVATE COLLECTION: Hundreds of aviation magazines for sale—*Popular Aviation, Flying, Model Airplane News, Air Trails, RAF Flying Review, Wings,* and many others. 1932-1960. All in excellent condition. Send $2 for list. William C. Fort Jr., 4161 Robin Hood Rd., Jacksonville, FL 32210.

R/C SCALE PLANS: Curtiss P6E, Stearman PT17, others—1/6-scale $22.50, 1/4-scale $35.50, catalog $1. Richard Barron, 11506 Ohio Ave., Youngtown, AZ 85363.

SCALE DOCUMENTATION: PLAN ENLARGING. Photo packs, 3-views, drawings for 1,600 aircraft, super-scale R/C plans for Giant, Sport; 30-page catalog $3. Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; 919-292-5239.

WANTED: Kraft Systems KP 7C, 7CS, 5C, 5CS, and Signature Series radios any year. We have many Kraft parts in stock, call or send SASE for listing. Also many older collectable American-made radios in stock. From 1950s to the present. Need Ni-Cd packs? Please call for outstanding prices on Ni-Cd packs for any system. These packs far surpass originals and are American-made, not imports. Call for prices and ordering info. Yes, we do have reed systems in stock, complete and working. Kraft Channel Master Systems are getting low. Get yours before they are gone: still $125. Jay-En R/C, P.O. Box 4248, Hilo, HI 96720; 808-966-6175 after 5:00 p.m. Weekends all day.

SEMI-KITS FABRICATED from your plans. Parts cut from balsa, bass, pine, maple, and plywood. Custom wood sizes and shapes cut from your specs. Send SASE for quotes. Model Wood Specialties, 4209 24th St., Kenosha, WI 53142.

NATIONWIDE PHOTO ADS: Buy, sell, trade hobby things cheaply, quickly, easily, $2 ads, $3 w/photo, $2 for circular. Send SASE to Nationwide Model Exchange, 4444 Hazeltine #116, Sherman Oaks, CA 91423.

FOR SALE—GREAT OPPORTUNITY: Schluter Heli-Star helicopter constructed by perfectionist and flown only one hour, Futaba 7-channel radio, and full accessory list too large to mention—all new. Retail value over $3,000, yours for only $1,500 firm. Call 617-295-7476 days and 295-7351 evenings. This won't last long.

HOLIDAY IN GERMANY: We, a German couple aged 35/37 and model airplane fliers, gladly invite an American couple to spend their 1987 holidays with us. In return we would visit you in the U.S. in 1988. Knowledge of the German language would be an advantage but not necessary. Contact K.H. Werner, Obere Muehle 37, 5860 Iserlohn, West Germany; tel. 02371-12558.

JETEX ITEMS AND KIT WANTED for cash. Kits by such makers as American Telasco, Berkeley, Comet, Cleveland, Monogram, Tailored, and others. Paul Williamson, 5032 S. Ridgeview, Nashville, TN 37220.

WANTED TO BUY 1930-1950 *MODEL AIRPLANE NEWS* by collector, good price paid for copies in fair condition. Pat Snodin, "Larchmont," 6A The Avenue, Dallington, Northampton, United Kingdom.

Send ad and payment to *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897. **Non-Commercial classified ads** (commercial ads of any kind not accepted at this special rate). Rate: 15 words or less, $4.50 payable in advance. No charge for name and address. Additional words, 25¢ each. **Commercial classified ads** (rate applies to anyone selling on a commercial basis—retailers, manufacturers, etc.). Rate: 50¢ per word, payable in advance. Count all initials, numbers, name, address, city and state, zip and phone number. **Closing Date** for either type of ad is the 15th of the third preceding month (for example, January 15th for the April issue). We do not furnish box numbers. If you would like your ad to run in more than one issue, multiply amount of payment by number of months that ad is to run. It is not our policy to send sample copies or tear sheets.